THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE TRAINING OF MEN OF SCIENCE.

A RECENT issue of our American contemporary, *Science*, contains the text of an address delivered by Prof. C. F. Mabery, of the Case School of Applied Science, to Section C of the American Association for the Advancement of Science some months ago. Prof. Mabery took for the title of his address "The Education of the Professional Chemist," but it seems that many of the opinions he expresses and the suggestions he makes apply equally to electricians and engineers. After girding at the education given in many secondary schools, where boys are not taught such principles of science as may be easily acquired from acute observation of daily phenomena until they are past the most perceptive age; and where afterwards they are frequently taught a book rather than the subject it is intended to explain, Prof. Mabery develops a view we have not noticed in print before. The author holds that the career of the professional chemist—and we assume he will allow us to read electrician as well—"depends in no small degree upon inheritance." He considers that quick perception and a logical habit of mind are as much inborn as energy and ability, and that a large proportion of average students lack the mental poise and manual dexterity necessary for success on a broad scale. In this connection, of course, Prof. Mabery is compelled to accept the general commercial definition of the word "success," as meaning adequate pecuniary compensation—a definition which, unfortunately, only the man of science whose mind has become distorted by the inheritance or early acquisition of a competency can, perhaps, honestly dispute.

Later on in his paper, Prof. Mabery examines an analogy he himself—or some other author, we are not clear which—has drawn between the concentration of huge business enterprises into the hands of one man or one board of directors and the concentration of science teaching in every branch within the walls of one single establishment, *e.g.*, a university. The former operation has undoubtedly proved successful, diminishing expenses, securing uniformity in output, and (shall we add) controlling the market. A similar concentration in the case of science teaching, however, is not to be regarded as equally desirable. The head of a science school must be a man of science, regarding science as of capital importance to the institution and to its students; but the dean of a university can only look on science as one branch of the curriculum—one of many subjects for which the university is renowned, one of many subjects the students come to learn.

In the closing pages of his address, Prof. Mabery deals with that very distasteful subject that has inevitably come into prominence of late—viz., a man's tenure of activity. In the last generation, the chief of an enterprise attended his office in conventional hours, wrote his own letters, and led a quiet business life, enjoying good health to the day of his death. Now his successor has no fixed hours; the

telephone, telegraph and express train keep his brain, if not his body, chained to the desk for nearly 24 hours per day: and even the heads of departments have to assume so much responsibility as to live the life of a general practitioner in medicine—the slave of his patients at all hours, save during his annual holiday away from town. The youth of to-day whose brains are his only negotiable asset, says Prof. Mabery, must make his reputation, amass his fortune, derive his enjoyment and pleasure from his business affairs, and be ready to resign his place when he is fifty or sixty years old, just when the normal man is at his best, just when he has lived long enough to possess sound and rapid judgment. And this limitation in the period of a man's activity is the more serious amongst students of science who have had to spend eight years or more in gaining their education; and who, we may add, rarely acquire the leisure and means needed to enter into matrimony until the best season for that duty to the State has passed. Small wonder it is, if Prof. Mabery, in expressing the gratitude which all Americans ought to feel to the countless rich men who have given of their plenty to the educational establishments of the States, singles out for special admiration the Carnegie foundation for the retirement of teachers; a benefaction which relieves the professor lucky enough to come within its protection from much of the anxiety that any poor man must feel during the earlier years of his active life, as to his ability to maintain himself and his dependents when the day of work is past.

The Report of the Select Committee on the Radio-telegraphic Convention.

In this issue we give the chief features of the report in which the ratification of the Convention is recommended. The Committee have dealt thoroughly with the whole question, and, in our opinion, the only possible justifiable recommendation has been given. Under present conditions, that is to say, if the Convention is not agreed to, this country will be at tremendous disadvantages commercially, politically, and strategically; whilst if the Convention is agreed to, we shall be clear of all those disadvantages, and yet no worse off in other respects. As was to be expected, the only objections raised were by the Marconi Co., whose evidence gives one the impression that they are afraid of being supplanted, which is tantamount to admitting inferiority. Be this as it may, it is really very shortsighted policy on their part, as they would undoubtedly suffer more by remaining alone than if general intercommunication is compulsory. Two very important points are emphasised by the Committee: (1) the Marconi witnesses first alleged that the technical provisions were incomplete and unscientific; and, subsequently, when this allegation had been refuted, that the provisions would not be effective; (2) The desire, apparently, of the Marconi Co. to evade the spirit of their agreement with the Postmaster-General to the obligation of intercommunication when desired by a convention. The words of the report are:—"If this intention was in the minds of the Marconi Co. when they negotiated the agreement it would appear to be open to grave criticism, in that they are now endeavouring to evade the main condition which led the Postmaster-General to enter into an agreement granting them advantages which they have enjoyed, still enjoy, and propose to retain."

The "Electrical Review" and Municipal Enterprise.

In our "Correspondence" columns we publish a letter received from Mr. Burnett, of Barrow-in-Furness, in relation to what we consider a perfectly just criticism of a paper read by himself at the recent Convention of the I.M.E.A. at Sheffield, in which he imputes to us an antagonistic feeling to anything municipal, an imputation which we entirely repudiate. Surely, our wish to see these Conventions supplied with better food for discussion than that served up at the recent meeting cannot be construed into antagonism. What we have deprecated in connection with the municipal electrical undertakings has been the unsound finance and the want of business ability which sometimes have characterised their control. Our crusade, if such it may be termed, has been amply justified by the results, for we find, all too tardily, the policy of sounder finance which we have persistently and, we think, consistently advocated for years past, being adopted, or, at rate, far more favourably considered in many parts of the kingdom. We have devoted a great deal of our space to chronicling the initiation and progress of municipal electrical undertakings for the past 15 years and more—indeed, ever since there began to be such. We have not failed to give credit for good work and enterprise—whether of an engineering or financial character—whenever we have thought it deserved, and in our analyses of Electric Supply and Tramway Accounts we have frequently congratulated municipal engineers and managers when they have shown progress of a particular kind. All who read our suggestion in these columns last week must realise that it is our desire to see these conventions become a benefit to municipal undertakings, and we are convinced that just criticism will eliminate such hasty and ill-considered work as has been presented for discussion in the past. We think it is a slur upon the intelligence of municipal engineers and members of committees to state that the form adopted by Mr. Burnett on fig. 1 of his paper is more expressive and more easily understood than actual figures. We think that there are men in the municipal electrical world who are capable of advancing the industry considerably by publishing from time to time the results, and methods of obtaining the results, of the work carried out in their respective undertakings, and we are, and always have been, ready and willing to publish in our columns such results and methods when obtained, therefore Mr. Burnett's imputation of antagonism is absolutely baseless.

Prof. Ayrton on Research.

The "special article" in the Engineering Supplement of the *Times* of July 10th last consists of a paper by Prof. W. E. Ayrton, F.R.S., entitled "The Research Student," which everybody with an acute attack of dyspepsia will read with a great deal of pleasure. Prof. Ayrton writes at large about students, professors, universities, and geniuses, and falls foul of nearly everybody. The writer condemns the professor who can always find something for a student to do in his laboratory; the University of London who yearns to recognise as a teacher a person who has published something, or has taken a degree, irrespective of his power to teach; a Poet Laureate who has to produce an immortal masterpiece every year; Mr. McKenna who stated that the aim of the Imperial College of Science and Technology to which a Charter was given by His Majesty a few weeks ago, was essentially the same as that of the City and Guilds Technical College as announced 23 years back. In fact, the only people whom Prof. Ayrton seems to admire are the great investigators of days gone by—and they are mostly dead. However, the research student does come in for a qualified word of praise, because Prof. Ayrton admits that the youth who has gained a scholarship which is supposed to endow him whilst performing research has at any rate learnt how to search for endowment.

To be serious for a moment, Prof. Ayrton's article, though pessimistic, is very useful, especially in the Journal where it appears. Some years ago, when the subject of England's need for science first cropped up, pessimism ruled supreme. Latterly, on the other hand, optimism has prevailed in excess, and it is doubtless quite time for members of the public and other people who contribute money to educational establishments, to be warned that a large proportion of the students who gain scholarships, and a very large proportion of the literature they add to our technical journals, represent no adequate return for the money spent. Prof. Ayrton seems

unnecessarily bitter about certain members of the governing body of the Imperial College of Science. Such individuals may "scowl" at the notion that some of our most valuable research students have been practical men, but provided only these individuals are in a minority amongst the sacred 39, their little fads are not of much importance.

Copper Prices and Speculation.

AN agitation is proceeding in Germany with a view to the establishment of a metal exchange in Berlin, particularly for copper, lead, spelter and tin, for the purpose of emancipating merchants, as is contended, from the control of the London Metal Exchange in the matter of quotations, if not from that of the American interests. Although the scheme is merely in an initial stage, and there is no certainty that it will reach maturity, it may be of value to refer to the opinion expressed by Dr. E. Budde, director of the Siemens & Halske Co., in relation to the question as it affects copper from the standpoint of a large consumer. Dr. Budde points out that at the present time practically the whole of the trade in copper passes through the hands of five firms, one of which is located in Germany, two are in England, and two in the United States. These firms have never taken advantage of their powerful position, and they have a peculiarity which is of preponderating importance for consumers—they really have behind them the copper in which they deal. As a consequence the enormous increase in prices is not a result of the formation of corners, or of speculation on the London Exchange, but is a natural sequence to the fact that the consumption of copper in recent times has constantly exceeded the production. As compared with the five firms who actually have the copper at their back, the position might be, the director of the Berlin company submits, that there would be 50 or 500 speculators without any copper in the event of the creation of a metal exchange. There would obviously ensue from this circumstance the danger of wide fluctuations in prices without the situation of the market justifying these movements. In addition to this, if consumers were simple enough to purchase from speculators, they would be exposed to the danger of the agreed-upon deliveries not being duly and fully effected at the right time. The conclusion of Dr. Budde, in these circumstances, is that the need for a German copper exchange has not been demonstrated. The actual consumers on a large scale would, in his opinion, not permit themselves to be led away by speculators, but would ignore the exchange as far as possible, and restrict their purchases to the firms who, as hitherto, afford the certainty that the material will be appropriately and certainly delivered. These expressions on the part of a representative large consumer, if participated in by other users of copper in considerable quantities, will scarcely tend to instil confidence in the minds of the promoters of the scheme for an exchange in so far as copper is concerned. The curious fact in connection with the project is that the Frankfort company solely affected by copper, and which is in close relations with the London interests, has so far not ventured to intimate its possible attitude in the matter, and no one seems to have thought of asking for information on the subject from it.

Electrolytic Disinfectant at Poplar.

DR. F. W. ALEXANDER'S annual report for the year 1906 contains a description of the Hermite plant at Poplar used for supplying electrolytically produced solutions of sodium hypochlorite for disinfecting purposes. It opens with a description of the process and methods of working, which need not again be referred to in these pages. Regarded commercially, the report is of considerable interest, as during twelve months some 17,000 gallons of fluid have been manufactured of a strength between 4·0 and 4·5 grammes of available chlorine per litre.

"The fluid has been issued to the public in pint bottles from the depôts at Old Ford Road, Bickmore Street, and West Ferry Road, and from the manufacturing depôt, Violet Road. For watering the roads, market places, &c., the Works Department has been furnished with 9,116 gallons, at a charge of 1d. per gallon. The Poplar Guardians, for their institutions inside and outside the borough, and the managers of the Sick Asylums, Blackwall and Devon's Road, have been supplied with 568 gallons during the last four months of the year's working, for which no charge has been made.

"There have been required 2,543 units of electrical energy at 1½d. per unit, four tons of salt have been used at 24s. per ton, and two tons of chloride of magnesium at £3 17s. 6d. per ton, caustic soda costing £4 0s. 8d., water, together with that used for washing out the electrolysers, and for other purposes, £2 15s. 8d., including meter rent."

As regards the comparative costs of the hypochlorite solutions and the carbolic disinfectants previously supplied, we note that for the years 1903, 1904 and 1905 respectively, the cost, including bottles, labels, wages, and distribution, was respectively £664, £771 and £862. The capital outlay on the electrolyser, including erection and a stock of carboys, amounted to £583 9s. 2d. The total costs of manufacture and distribution, including the item of £30 for rent, amounted to a gross sum of £635 13s. 11d. Deducting £37 19s. 8d. received from the Works Department for 9,116 gallons of solution supplied to them, the net cost (excluding interest and depreciation on capital outlay) works out at £635 13s. 11d., a sum of £255 less than was expended in the preceding year.

This is really a very creditable performance. The equipment was, we believe, paid for out of revenue, and therefore the question of interest upon this item need not be raised. As regards depreciation, we cannot accept the view held by the inventor that all is indestructible save the zinc electrodes. The depreciation of the original platinum wire electrodes of this installation through actual disintegration would be very slight, and incidentally through the present high price of platinum there has been at Poplar a probable appreciation in value.

There are several really good processes for making hypochlorite solutions, essential variations lying in electrode design, current density, energy efficiency, and salt consumption. Dr. Alexander has done good pioneer service in this field, and we look in the future to similar plants being widely used by municipal authorities. The solutions are cheap and effective, and have also the merit of being non-poisonous.

Municipal Electricity in Sydney.

THE advent of a municipal supply in the City of Sydney has developed in a wonderful way the demand for electricity, due no doubt to the reduced rates introduced, for though the City Council is doing a business this year of over 3 million units, the private companies are selling more than they ever did before. There are five such companies operating, all with overhead wires in separate districts, and having an aggregate of about 2,500 KW. of plant. The Council, considering that the City would be better served by a centralisation of the electricity supply business under its own control, recently concluded an agreement with the Empire Electric Light Co., Ltd., by which the latter agreed to transfer all its customers to the Council's mains. This company has been most successful during the past 10 years, and the acquisition of its business will add another million units to the Council's output.

The method of carrying out the deal is novel, and probably unique, as the company is returning to its shareholders their capital, and the Council is obtaining the load without any actual outlay. Briefly, the transferred customers' loads will be regarded as a bulk supply, and the difference between the revenue derived from this supply and the "bulk" price charged (1d. per unit) to the Empire Co. will go towards the reduction of the purchase price and interest on the unrepaid capital. It is estimated that four years will wipe off the debt. The other companies may be dealt with in a similar manner later on. We commend this arrangement to the consideration of would-be municipal purchasers over here.

D

HIGH-SPEED WIRELESS.

In March, 1905, at the Royal Institution, Mr. Marconi, in delivering a lecture on the development of wireless telegraphy, gave a most interesting demonstration of high-speed wireless working with a Wheatstone telegraph transmitter actuating a heavy type of relay, which made or broke the primary circuit of the lecturer's spark coil. The two aerials were only a few feet apart, so that the exhibition was given under much more favourable conditions than exist in practical wireless telegraphy. It was stated that a speed of 100 words per minute had been obtained, but this was certainly not the speed at the exhibition, for expert operators were able to read the Morse signals from the noise made by the spark, and they estimated the speed as being not more than 40 words per minute. Since that time nothing further has been heard of high-speed wireless, and it is observed that the Poldhu station still signals to the Atlantic liners at the rate of about 15 words per minute.

Great endeavours have been made to obtain freedom from interference between neighbouring stations, for the highly important reason that for key speed working a multiplex system must be employed to deal efficiently with quantities of work.

Large expensive stations such as Poldhu, working at such a comparatively low speed, make wireless messages very costly, and if the volume of work increases sufficiently, it would hardly be practicable to reduce the charges if a second station had to be erected to deal with the increased work. Hence the obvious need to develop high-speed working. The British Post Office have had this desirability always in view, and have recently carried out a few preliminary experiments between two of their stations 15 miles apart.

The results obtained are certainly very promising, and indicate that Wheatstone working is a practical possibility.

In these experiments the received oscillations actuated a wireless receiver, which, in turn, acted on a syphon recorder, causing the Morse signals to be written in a continuous wavy line. The accompanying illustrations are photographs of the actual received signals, and show the dots and dashes recorded in an upward direction in the first case, and in a downward direction in the others.

At slow speeds the signals are very distinct, and the ink line is remarkably steady.

The first illustration shows hand signalling as fast as the operator was able to send. It will be observed that, although a very fair sender, the speed was such that he occasionally missed dots and shortened his spacing. His speed was estimated at 35 words per minute.

The remaining specimens were signalled by a Wheatstone transmitter, and, although more perfectly transmitted, the receiver was not in such good condition as on the first occasion. The experiments, however, were preliminary ones only, to obtain some idea of the speed of working.

Some trouble was experienced at the sending end with the make-and-break contacts in the primary circuit, but in spite of this bad effect upon the accuracy of the signals, they are distinctly readable at 70 words per minute, although practically unreadable at 90 words per minute.

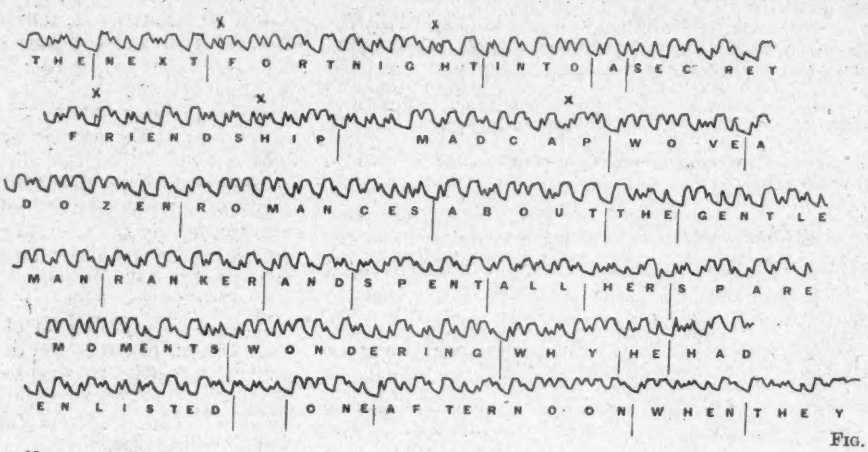

THE NEXT FORTNIGHT INTO A SECRET
FRIENDSHIP MADCAP WOVE A
DOZEN ROMANCES ABOUT THE GENTLE
MAN RANKER AND SPENT ALL HERS PARE
MOMENTS WONDERING WHY HE HAD
ENLISTED ONE AFTERNOON WHEN THEY

Fig. 1.

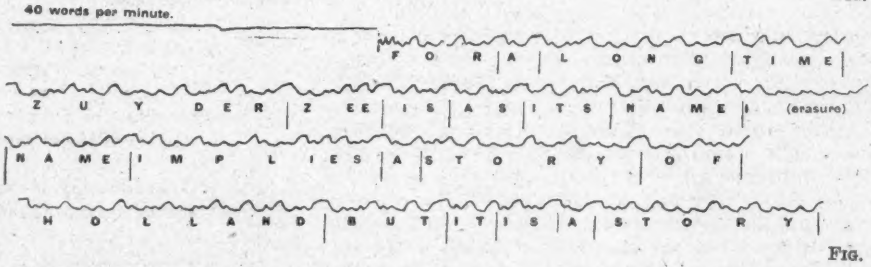


Fig. 2.

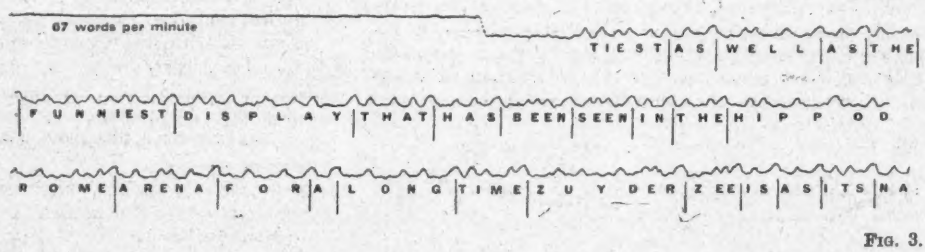

67 words per minute
TIEST AS WELL AS THE
FUNNIEST DISPLAY THAT HAS BEEN SEEN IN THE HIPPOD
ROME ARENA FOR A LONG TIME ZUYDER ZEE IS AS ITS NA

Fig. 3.

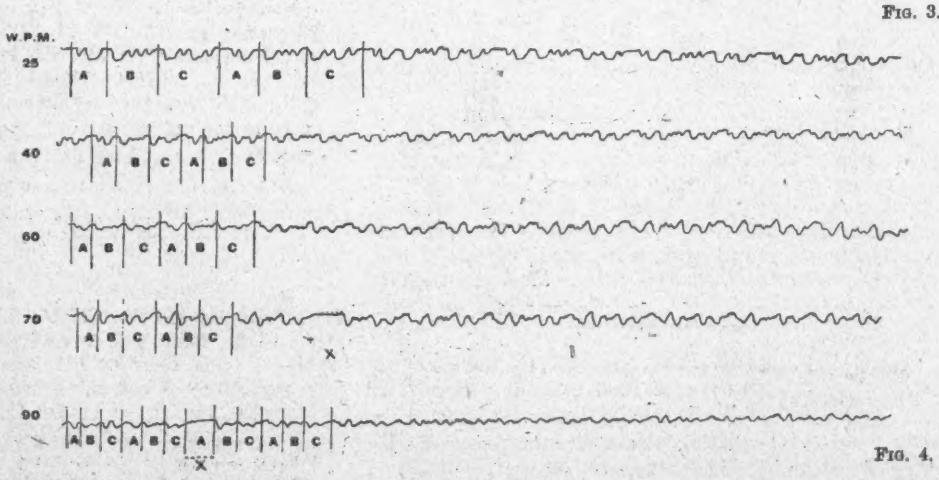


Fig. 4.

At the latter speed two important limiting factors arose—viz., the speed of the syphon recorder at its particular adjustment and the rate of sparking at the sending end.

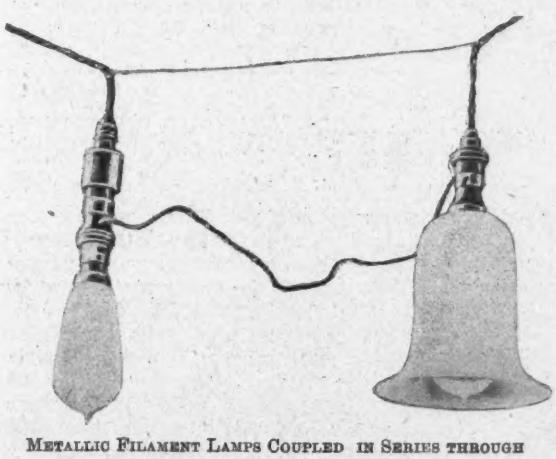
It is obvious that the trouble at the sending contacts can be practically eliminated, and that the rate of sparking can be increased. Hence there is every likelihood of good signals being obtained at a higher speed than 70 words per minute.

So far as can be ascertained, the foregoing experiments constitute a record advance in the progress of wireless telegraphy working under practical conditions.

It would be interesting to hear from any of our readers who may have observed the signals from these experiments, which, we are informed, took place on June 25th and 26th last.

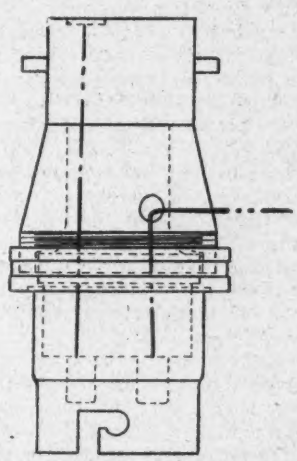
THE PRESENT POSSIBILITIES OF METALLIC FILAMENT LAMPS.

The difficulty in obtaining supplies of lamps of the Tungsten group, coupled with the fact that their present working pressure appears to be limited to 100 or 110 volts, has so far put obstacles in the way of their general application. Few consumers at the present stage feel justified in incurring the expense of altering their installation in order to effect a first economy in use, which is to some extent discounted by the high price and greater candle-power of the lamps supplied, and is ultimately an uncertain quantity, owing to the little information available with regard to life and durability under ordinary conditions of use. The fact that more light is available with less consumption of energy also offers little inducement to supply engineers to introduce these novelties to those of their consumers who are content with the carbon lamps in general use, and certainly whilst the first cost of the lamps is high and the supply limited, as it appears to be, by conditions other than those of restricted demand, their introduction in certain quarters might entail some considerable loss to an undertaking before an adequate supply and fall in prices would enable it to recoup itself by new or increased connections. However, it seems probable that



Metallic Filament Lamps Coupled in Series through Special Adapters.

increased use of the lamps must precede, rather than follow, that adequate supply and reduction in price, to which so many engineers are eagerly looking forward as a means of regaining lost ground and securing the custom of those classes of the community for whom a strong, cheap light outweighs æsthetic considerations. In spite of these difficulties, an immediate sphere of usefulness and a good advertisement for the high efficiency lamp in its present form appears to present itself in its application to some of those cases where the cost of electric light has rendered a consumer dissatisfied and open to the propositions of the gas suppliers. Many cases may be found where the introduction of a few metallic lamps in long-burning positions would largely reduce the total cost of energy consumed in an installation, whilst providing increased light. On alternating current systems, this may be effected in an inexpensive manner by the use of small transformers, which give the necessary pressure reduction without excessive internal losses, particularly if it be possible to divide the installation in an approximately equal manner with regard to the lamps alight at one time. An auto-transformer, similar to those employed for supplying alternating current arc lamps, can be used, in which the internal losses are so low that a large net saving in consumption can be shown. For example, with the best grade of magnetic iron now



Adapter Arranged for Coupling Metallic Filament Lamps in Series, using Ordinary Sockets.

obtainable three-wire auto coils have been constructed capable of dealing with an out-of-balance current of 3 amperes, and in which the losses did not exceed 3½ watts. Taking the case of a shop or business where artificial light is used to a late hour, such a customer is desirable to the Supply Authority, but in many lines of business, unable or unwilling to pay enough to procure the blaze of light which he requires by means of ordinary incandescent lamps. Here an opportunity presents itself for the use of current-saving lamps, even at considerably greater first cost. With an alternating current supply and the installations divided into equal groups of about 100 volts pressure by means of auto-transformers, an improvement of the following order may be anticipated :—Taking 10 30-watt lamps of 32 nominal candle-power, the maximum out-of-balance current will be about 1·5 amperes. An auto coil to deal with this can be obtained for £3, having a consumption not exceeding 3½ watts. If this voltage reducing apparatus be erected and energised at the expense of the Supply Authority the yearly cost will be :—

£3 at, say, 10 per cent. for capital charges and depreciation	6s. 0d.
$\frac{3{\cdot}5 \text{ watts} \times 8{,}760 \text{ hours}}{1{,}000}$ = 30·66 units at, say, 1d.	2s. 7d.
	8s. 7d.

say, 10s. per annum, which should be easily recoverable as a rental. The comparison in cost of the lighting between carbon and metal filaments per year of 1,800 hours, would be as follows :—

Metal.		Carbon.	
10 32-c.p. 30-watt lamps, 320 c.p.		10 16-c.p. 60-watt lamps, 160 c.p.	
$\frac{10 \times 30 \times 1{,}800}{1{,}000}$ = 540		$\frac{10 \times 60 \times 1{,}800}{1{,}000}$ = 1,080	
540 units at 4d. ...	£9 0	1,080 units at 4d. ...	£18 0
Extra rental of an auto coil	0 10	Say, three renewals of lamps (average life 600 hours), 30 at 1s....	1 10
Say, three renewals of lamps (average life 600 hours), 30 at 4s....	6 0		£19 10
	£15 10		

Showing in favour of the metallic lamp an economy of over 20 per cent., with a nominal increase in light of 100 per cent. With the introduction of a 16-c.p. unit the above

economy could be increased to about 60 per cent. with equal illumination. But probably the fact that there is a considerable saving in the use of the, at present, smallest unit above the 16-c.p. carbon lamp, will prevent any great demand for smaller lamps. In many cases, dissatisfaction with the cost of electricity, particularly in business premises, is as easily remedied by increased lighting as by a reduction in charges. Where, owing to the use of direct current or other causes, it becomes necessary to burn pairs of lamps in series, some attempt should be made to match them in order to get equal light and life. These drawbacks, coupled with the necessity of burning two high-pressure lamps at a time, render it difficult to extend this manner of using them, but there are many instances where an inexpensive fitting will make it possible to use two 32-c.p. lamps in series instead of a cluster of three 16-c.p. carbon lamps, with a great saving in energy, and similarly single lamps can be replaced in pairs by an alteration in the wiring, or, where this is undesirable, a pair of series adapters having one contact in each, joined by a single flexible cord, can be employed, making it possible to burn two lamps of half the supply pressure in series on any two holders.

In supplying these improved lamps it is not difficult to arrange that they shall be slightly under-run, which will have a beneficial effect upon their life. In several instances "Osram" lamps have been burned in this way in pairs for 800 to 1,200 hours under ordinary conditions, with no appreciable loss of lighting power.

In their present form the principal disadvantages of these lamps are fragility and softening of the filaments when heated, making it necessary to hang them vertically downward. The possibility of mending broken filaments by fusing their ends together is of more interest than real value, as it results in shorter active filament and decreased life. As an offset to these difficulties the lamp is to be credited with an intense white light, very high efficiency, small variation with change of pressure, coolness, and apparently an average life at least equal to that of carbon lamps, all considerations which render it deserving of the attention of supply engineers.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Literary Engineer.

May I intrude once more upon your valuable space to reply briefly to Mr. Sydney F. Walker, who, after accusing me of tilting at windmills, tilts at something even more chimerical and unstable—the wind itself. Unless my memory deceives me, I did not mention in my previous letter Greek or Roman literature among the intellectual pursuits which I advocated, and am quite at one with Mr. Walker in recommending the modern classics as an equally efficacious and probably more convenient study.

It is comforting to hear of some one who believes that the type of engineer which we have been discussing met his final end 30 years ago, but my experience leads me to believe that, here in London at least, he is not quite extinct.

Of course, in Bath they may manage things differently.

W. J. H.

Westminster, S.W., *July 12th*, 1907.

I.M.E.A. Convention.

Your antipathy to anything municipal is so well known by your readers that I should not have taken any notice of your scathing criticisms of the I.M.E.A. Convention in general, but for the fact that you pay particular attention to the part which I took therein.

In commenting upon Thursday's proceedings, I note that you fail to grasp the significance of the curves given in fig. 1 of my paper, but I venture to think that every central station engineer who read the paper would be capable of realising their meaning.

As explained in the paper, the curves were obtained by plotting the quarterly output and costs. The slight discrepancy between the curves and the text to which you draw attention is due to a clerical error, which unfortunately escaped notice in the correction of the proofs.

Apparently you have also failed to grasp the fact that increase in output does not materially reduce the *running costs* per unit (which depend upon the size and output of plant installed, local conditions, &c.), but does, of course, decrease the *average costs* per unit, by distributing the standing costs over a larger number of units. I did not contend that a curve was necessary to explain the law representing the costs of supply, but I think that to 99 out of every 100 engineers or committeemen, the curve given in my paper would be more expressive than the figures which it represents.

Whatever may have been the merits or otherwise of the papers read at the Sheffield Convention, I think that few who attended it would endorse your opinion as to their being "crude and inept," or begrudge the "considerable period of valuable time" expended in attending the meetings.

H. R. Burnett,
Borough Electrical Engineer.

Barrow-in-Furness, *July 10th*, 1907.

[The reference to antipathy on our part to anything municipal is dealt with on page 82.

We regret that Mr. Burnett's letter compels us to publish details upon which our "scathing criticisms" were based.

In his paper Mr. Burnett published a form described as a quarterly balance-sheet, and distinctly stated that "the figures obtained from these quarterly balance-sheets are plotted as in fig. 1," and yet he further states that "from the curve A B, fig. 1, it will be seen that the law for the costs of supply from these particular works during 1905-6 was :—Total costs = £2,247 per quarter + 0·60d. per unit sold."

Both statements cannot be correct, neither can Mr. Burnett ascribe the inaccuracy to a clerical error. We assumed that the curve was plotted from annual standing charges ÷ 4 + 0·6d. running costs, and therefore failed to grasp the significance of the term "quarterly costs of supply, 1905-6." However, we should not have cavilled at this inaccuracy if Mr. Burnett had been correct on the main points of his assumption.

It is quite evident that our criticism was justified when it produces the amazing statement in his letter: "Apparently you have also failed to grasp the fact that increase in output does not materially reduce the running costs per unit." Of course, as Mr. Burnett states, running costs "depend upon the size and output of plant installed," but for the 50,000 units output per quarter smaller plant units would be used than for the 300,000 units output, and probably the plant load factor would be considerably greater with the larger output; both circumstances would considerably affect running costs. If stand-by losses are also taken into account, the difference will be still greater, but possibly Mr. Burnett has included stand-by losses in his standing charges; if so, then we assert that if he had dealt with his method of ascertaining stand-by costs, which would have been well within the scope of his paper, the value of his production would have been considerably enhanced; but if, on the other hand, stand-by losses were not included in standing charges, Mr. Burnett's statement is doubly amazing.

Then, again, the figures given by Mr. Burnett do not tally with the published records of his undertaking. The total working costs for the year were £5,180, so that if we take from fig. 1 standing charges £757 × 4, we have a balance of £2,152 running costs, which, divided by the total output, 917,925 units = 0·56d. per unit, not 0·6d. From published records we also find that the works costs are made up as follows, viz. :—

Coal, &c.	0·45d.	=	£1,721
Water and stores	0·06d.	=	229
Wages	0·27d.	=	1,033
Repairs and maintenance ...	0·20d.	=	765
Works costs	0·98d.	=	£3,748 (actual £3,744).
Standing charges	£398 × 4	=	1,592
Leaving, as stated above, running costs...			£2,152

We think, in the interests of the electrical world in general, municipal or otherwise, that we are entitled to call upon Mr. Burnett to explain the system by which he apportions this £2,152 to running costs, and £1,592 to standing charges—this we will undertake to publish; but if the information is not forthcoming, we must adhere to our opinion that the paper was "crude and inept," an opinion which we venture to state will be supported by the 99 per cent. of the engineers and committeemen to whom the curve given in the paper is claimed as being more expressive than the figures which it represents.—EDS. E.R.]

Johannesburg Municipal Gas, Electric Supply and Tramways Department.

I notice that the following appears in your issue dated May 24th, in connection with a resolution passed by the ratepayers of Johannesburg on April 20th last:—

> In referring to the Tramway and Lighting Department, it was stated that it was over-staffed, the number of whites employed being 451 and natives 803. The office staff was: 55 for the general manager's department, 20 for the traffic manager's department, and 16 for the treasury department; a grand total of 1,350.

As this is neither correct nor complete, I give you below the correct figures:—

General manager's staff (technical and clerical)	34	(not 55)
Traffic office staff	18	(not 20)
Treasury department	16	
White men	451	
Natives	755	(not 808)
Making a total of ...	1,274	(instead of 1,350)

The statement omitted to say that the staff of the gas-works was included in the above, also a number of white men and natives temporarily employed on construction works; and as it is likely to give a wrong impression, I shall be glad if you will publish this letter. The number of men employed in the above department is no larger than in similar-sized undertakings elsewhere.

J. F. I. Thomas,
General Manager.

Johannesburg, *June 19th*, 1907.

Making Calcium Carbide in Ireland.

In reference to Mr. Bingham's letter in your last issue, he directly points out where the shoe pinches at the very commencement by stating that he is managing-director of three carbide works—consequently my recent letters are strongly detrimental to the importation of foreign carbide, for which he is practically sole agent. Evidently his idea was to convey the impression that he was the chief and only authority on carbide; this being the case, I must request Mr. Bingham to point out in detail how it is impossible for me to produce carbide at £5 per ton, under the conditions stated in my letter, viz., 500 H.P. nine months in the year at £1 the H.P., and lime at 12s. per ton; this should be easily done by a person with such experience and advantages. Then I will prove that it can be done (no endeavouring or I believe business about it, a man can believe or dispute anything, but to disprove it is quite another thing); at the same time I shall give reasons why and wherefore; moreover, there shall be no half-truth about it, which is the sum and substance of his letter. If Mr. Bingham wishes the public to be shown how cheaply carbide can be made I will do so, then the public will be able to judge whether I am the novice he wishes to suggest. What has first-class practical experience, backed by glowing testimonials, done for the carbide industry in England? It has been most successful in deceiving and in wasting people's money.

Mr. Bingham's letter was most uncalled for, and unwarranted in every respect save one, by my letters clashing with his vested interests, of which I had not the slightest intention.

I think he would have been acting wisely, not only in his own interests, but also that of others, to have left well alone; apparently he had doubts on this point, hence the lapse of time between June 21st and July 2nd.

Although I should never dream of advising anyone to harness a 100-H.P. water-right for the manufacture of carbide, I should have no hesitation in doing so with my own money—advantages being on a par with conditions specified—granted the undertaking would not carry a motor-car.

W. Antrobus.

Manchester, *July 13th*, 1907.

Hydraulic v. Electric Lifts.

As the compiler of the pamphlet on Hydraulic and Electric Lifts published by the London Hydraulic Power Co., I should like to make some remarks on Mr. Good's criticisms published in your issue of the 5th inst.

The charges of mis-statements are not justified.

The pamphlet confessedly deals with principles of construction in regard to safety and convenience, and with methods of calculation in regard to economy. Mr. Good has inadvertently done injustice to the contents. Take, for instance, the question of safety; the bad accident to which he alludes is, I have no doubt, that mentioned in the pamphlet as an instance of the risk due to overbalancing. Full particulars will be found in a paper on lifts which I read at the Institution of Mechanical Engineers 25 years ago. That particular kind of accident cannot happen to a lift designed without overbalancing.

The questions raised in the pamphlet are those of comparative safety. A suspended lift may be reasonably safe when every care is exercised, but the pamphlet gives reasons for placing the order of merit in regard to safety as—

1. Hydraulic ram lift.
2. Hydraulic suspended lift.
3. Electric suspended lift.

There are, I believe, no mis-statements in the reasons given. Each reader must judge for himself as to the correctness of the conclusions drawn.

Mr. Good considers that an improper use has been made of a diagram showing the relative consumption of power in working hydraulic and electric lifts, but at the same time he admits the accuracy of the curves. The authority for them is given. The lines have a relative, not an absolute, value in the pamphlet. The relative position of Mr. Good's lines will vary with every variation of price, and is not applicable to the particular matter which the diagram in the pamphlet illustrates.

With regard to Mr. Good's comments on the way in which the figures he originally gave have been dealt with in the Appendix, I must point out that the tables which he quotes are not given as his, but are part of the comment on his tables intended to show that his figures are in substantial agreement with the electric curves given in the diagram mentioned above. The figures have not been doubled; but if they were halved or doubled, they would still agree with the curves. I take it that when Mr. Good states that 20 up journeys of a lift cost 1d., and 7 down journeys cost 1d., it is fair comment to say that the down journey takes three times the power of the up journey, and that the power used for going up and down—*i.e.*, an all-round trip—would be $1 + 3 = 4$, and so on with the series, and in any unit of measurement that may be taken. The table to which Mr. Good objects is the sum of his figures, and is specifically stated to be such; but, whatever are the actual values, the proportions of the series remain, and the context deals with the proportions only.

The quotation from Sir William Preece's remarks is inaccurate. After giving various particulars, the words

used were these: "So that from actual experience the cost of working an electric lift against a hydraulic lift was, in the instance given, as 1 to 5."

The whole object of the pamphlet is to put users on their guard before they accept as correct general statements with regard to the points at issue, without having regard to the special circumstances.

On the question of relative prices for power, the charges both for hydraulic and electric energy are competitive; and if it were the case that the price per hydraulic unit is three times the electric, it would tend to show how much more effective hydraulic power must be for the particular purpose for which it is used, as the business is continually increasing.

Every care was taken to ensure accuracy, and a proof of the pamphlet was submitted to Mr. Good before publication.

E. B. Ellington.

Westminster, *July 11th*, 1907.

Names Wanted.—A correspondent wants to know the names and addresses of actual makers of Lyon's liquid stage resistances.

Another correspondent asks a similar question regarding the "Horstman" time switch.

"Lift" asks for the name and address of makers of "Standard Lift Controllers."

PROCEEDINGS OF INSTITUTIONS.

The Faraday Society.

As a pendant to recent discussions on the Ionic Hypothesis and Osmotic Pressure, the Faraday Society at its June meeting, held on the 25th ult., arranged what proved to be a very useful and illuminating general discussion on "The Hydrate Theory of Solutions," under the chairmanship of Prof. S. P. U. Pickering, F.R.S., one of the original authors of the theory in the early days when the subject did not excite anything like the interest that it apparently is able to do now. The general trend of the discussion, which was prefaced by four admirable papers written by Mr. W. R. Bousfield, K.C., and Dr. T. M. Lowry, Dr. J. C. Philip, Dr. G. Senter, and Dr. Alex. Findlay, leads one to believe that before long the old controversy between the associationists who favour the hydration theory, and the dissociationists, who champion the ionic theory, will die away in face of a combination of the two views, which, as a working hypothesis, more satisfactory than either, must certainly commend itself to moderate men at least, on both sides. Whether Prof. Armstrong will yield is, perhaps, another matter.

By way of introduction to our report of the discussion, a brief summary of the two theories, with mention of the chief difficulties standing in the way of each, will perhaps be useful. The hydrate theory supposes that when a salt dissolves in water, chemical combination between the two takes place, the salt remaining in substantially the same molecular state as in the solid. According to the ionic theory, on the other hand, a salt in solution is split up, more or less completely, into its constituent elements or radicals, not, however, in an atomic, but in an ionic form, one element carrying a positive charge of electricity, the other a negative. The main objections to the simple hydrate theory are, firstly, it does not account for the well-known phenomena accompanying electrolysis, the facts of migration and changes of concentration that occur, the observation that practically no E.M.F. is necessary to start electrolysis (after allowing for electrode effects), or, in other words, that no work is required to split up a dissolved salt, and so on. Secondly, it fails to account for the abnormally high osmotic pressures exerted by solutions of electrolytes. The extreme supporters of the theory, indeed, maintain that electrolytes have an abnormally high attractive action on the water molecules, and by thus rendering a proportionally large number of these *hors de combat*, so to speak, increase the osmotic pressure of the combination. Of this extra attraction, however, there is no evidence, and the supposition, according to Dr. Senter, fails not only to give a quantitative representation of the behaviour of aqueous solutions, but is further discounted by the fact that no direct connection between hydration and conductivity exists.

On the other hand, the ionic theory explains the facts of electrolysis with engaging completeness, and the difficulties in the way of accepting it, in its old form, arise from energy considerations. A concrete example will make the matter clear. When a molecular proportion of potassium chloride is dissolved in water, about 250 calories of heat are *developed*. To split up potassium chlorides, however, into its constituent molecules requires an *absorption* of 105,600 calories. The decomposition of the molecules into atoms will absorb still more energy, while a further quantity will be required to electrify the atoms and tear them asunder. To reconcile this discrepancy between the 100,000 odd calories that should be absorbed and the 250 calories that actually are evolved, it is necessary to look for some powerful exothermic reaction, and this is provided by a process of association between solvent and solute. Not, however, simple hydration as asserted by the old hydrate theory, but hydration of the separate charged positive and negative radicals—this is the fascinating suggestion put forward by Messrs. Bousfield and Lowry to account for the huge energy discrepency referred to, at the same time not disregarding the facts of electrolysis that imperatively demand some sort of ionic dissociation. According to this scheme, therefore, the affinity of the two ionic nuclei, $\overset{+}{K}$ and the $\overset{-}{Cl}$ for water, is the main source of the disruptive force which breaks down or ionises the molecule. The separate ions, so to speak, each attract, are surrounded by, and finally loaded with, a collection of water molecules, and the loading on the two sides of the salt molecule tears it asunder. One point only is a little suspicious in this otherwise beautiful hypothesis, and that is the very queer way in which energy required for dissociation should *just about balance* that yielded by the hydration of the separate ions. This may be a chance coincidence, but it is to be hoped that the authors of the theory will produce some satisfactory explanation of a decidedly strange fact.

The question now to be faced is, is there any independent evidence that the separate ions of an electrolyte are hydrated in aqueous solution? The results of such experiments and calculations as have at present been made cannot really be claimed as evidence on this point. The most reliable measurements on hydration available are those made by Dr. J. C. Philip (who contributed to the discussion), based on the diminution in solubility of neutral gases in water containing salts and certain other substances, the effect of which is to diminish the quantity of "free" solvent present. But these experiments are capable of other interpretations, and in any case they do not distinguish between total hydration and the separate hydration, if any, of the ions. Mr. Bousfield himself, from considerations based on the laws regulating the motion of a small body through a medium of great resistance has arrived at a formula connecting the average radius of a water-loaded ion with the dilution. The method is ingenious, but many assumptions have to be made, and some of the results are not consistent with those obtained in other ways. Perhaps the most convincing evidence in favour of the existence of separated hydrated ions is the agreement shown by Bousfield and Lowry to exist between the observed heat of formation of a salt in dilute solution and the sum of the calculated separate heats of formation of the ions. Prof. Pickering thinks the agreement savors of reasoning in a circle, proving nothing, but it does show that these figures for the ions are additive, and so far lends strong support to the idea that the ions are hydrated separately. On the whole, the position with regard to the theory of dissolved electrolytes is that while there is no direct evidence of a convincing nature in support of the hypothesis, the view that conducting solutions act so by virtue of their containing dissociated ions separately associated with molecules of the solvent, is one which combines the attractive features of the two rival theories, while at the same time it eliminates fairly satisfactorily the most serious difficulties inherent in each of them. In other words, it is a sound working hypothesis.

Physical Society.

At the meeting, held June 14th, 1907, Mr. H. M. Elder, Vice-President, in the chair, a paper by Mr. Upson, on the "Electric Arc," was read by the author. It dealt with observations made during the past session at the Pender Electrical Laboratory, at the suggestion and under the direction of Prof. Fleming, F.R.S., with the object of elucidating some of the facts connected with the production of electric arcs between cooled metal and carbon terminals, in air and hydrogen. Apparatus was exhibited for maintaining the arc in various gases, while one electrode was cooled by means of a water circulation. Arcs were described in which the electrodes consisted of carbon, copper, iron, and aluminium in different combinations, maintained in air, hydrogen, and coal-gas. With 110 volts supply, metal arcs in hydrogen took the form of a spark-discharge. At that voltage the maximum length of arc it was possible to obtain, with current up to 15 amperes, was 0·05 in., except where both electrodes were of the same metal. When carbon was one of the electrodes a true arc was formed. If carbon was negative the maximum length of arc with the above voltage was 0·07 in. Volt-ampere characteristic curves were shown for arcs in air and hydrogen of length 0·05 in. The slope of the curve (amperes horizontal, volts vertical) of the carbon arc in air, is much less steep than that of the curve of any arc in hydrogen. The former curve cuts the latter in the neighbourhood of 6·5 amperes. The curve for the arc with carbon positive, aluminium negative, in air, is very steep, being equal in this respect to the curves for arcs in hydrogen. It was much more difficult to obtain a carbon arc in hydrogen with alternating currents; and no arc could be obtained when the electrodes were copper positive, and carbon negative, with 100 volts supply and frequencies of 50 and 80. Similar results were obtained in coal-gas. Experiments were tried to determine how long the arc could remain extinguished without losing the power of restarting itself when the electromotive force was again applied. With cored carbons the time of interruption was greater than with solid, and both were much greater than that for the copper-carbon arc. In hydrogen the copper-carbon arc could not be made to restart itself if the electromotive force was removed for more than 0·04 of a second, and for this arc the minimum interruption possible was far shorter than for any carbon arc in air.

Mr. W. Duddell said the characteristic curves for arcs in coal-

gas or hydrogen were steeper than those in air, and therefore arcs in coal-gas were more suitable for the production of oscillations. He had noticed the phenomenon of an arc between two cored carbons re-lighting, and said that on high-voltage circuits the length of time was considerable, and amounted in some cases to seconds.

Mrs. Ayrton said it was difficult to arrive at any general conclusions from the author's curves. The steep parts depend not only on the composition of the electrodes, but on their size and on the length of the arc. The author had only used short arcs, which, with carbons, only gave the flat part of the curve; with metal-carbon you got the steep part.

Mr. Alexander Russell agreed with the author that coal-gas was very unsuitable for experiments with the arc. He had recently been experimenting with high-voltage alternating arcs in coal gas, and in most cases the enclosing vessel was soon filled with black cobwebs. When, however, the high-voltage high-frequency arc between iron-iron electrodes was shunted by a Leyden jar in series with a small coil of wire, the discharge between the electrodes became simply a torrent of sparks and no appreciable quantity of soot was formed. The difficulty the author experienced in certain cases in obtaining an arc was due probably to the low voltages used. When high voltages were applied it was easy enough to maintain an arc. In Dr. Simon's Laboratory at Göttingen, with the help of a motor-generator, 3 or 4 amperes of direct current could be obtained at 5,000 volts. The results already obtained were of great importance.

Experiments were then exhibited by Dr. J. A. Fleming, F.R.S., with the Poulsen arc as a means of obtaining continuous electrical oscillations. Dr. Fleming showed and described an apparatus for forming an electric arc in an atmosphere of coal gas between a carbon rod kept in slow rotation and a cooled copper anode, the arc being formed in a magnetic field of 600 to 1,000 C.G.S. units. The arc was supplied with continuous current at a pressure of 400-500 volts. A condenser of 0·003 mfd. capacity, in series with an inductance of 200,000 cm. was shunted across the arc, and experiments shown to prove the existence of high frequency oscillations in the condenser circuit. A long resonance helix of insulated wire was then joined to the condenser circuit, and when tuned to it, created a powerful high frequency field round it in which vacuum tubes glowed brilliantly. By vibrating or rotating a neon vacuum-tube of spectrum type near the helix, and showing that the band or disk of light was cut up by dark spaces, Dr. Fleming supported the contention that the oscillations so produced were not absolutely uninterrupted, but cut up into groups. Another experiment was shown to confirm this. The oscillations produced by the arc in one circuit was caused to create secondary oscillations in another circuit in which was a condenser shunted by one of Dr. Fleming's oscillation valves and a telephone. The valve rectified the secondary oscillations, and if they were absolutely continuous the telephone would be traversed by an uninterrupted direct current. But as a fact, a discontinuous sound was heard in the telephone which could only arise if the primary oscillations came in batches or groups.

Dr. Fleming then gave some figures showing the kind of values obtained for the efficiency of transformation of continuous to oscillatory current by the arc, and compared them with similar measurements for the spark method.

Mr. W. Duddell pointed out that it was possible to obtain continuous oscillations with a musical arc using high frequencies. He questioned Dr. Fleming's statement that the power put into the arc was equal to the product "A V," and said that the power should be measured with a wattmeter.

Mr. A. Campbell remarked that Mr. Altberg in Odessa had lately shown that sparks of high oscillation frequency produced actual air vibrations of the same frequency, and by measuring the wave-lengths of these air vibrations by diffraction methods he had been able to determine the high frequency.

Dr. Fleming, in reply, said he was prepared to accept Mr. Duddell's criticism that the power put into the Poulsen arc should be measured with the wattmeter. The really important matter, however, was the reason why the metal-carbon arc in coal-gas could produce oscillations of so much higher frequency than the carbon arc in air. This he thought was intimately connected with the slope of the characteristic curve.

Mr. Rollo Appleyard exhibited a direct-reading conductivity-bridge for testing rods of steel or other material, where there is considerable range of conductivity between successive specimens, and where it is necessary to eliminate the resistance of end contacts.

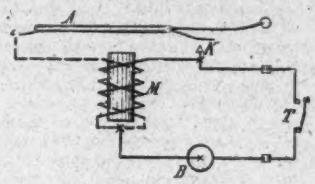
Mr. A. Campbell said he had used the author's conductometer and testified to its convenience. He objected, however, to the measurement of conductivity in terms of Matthiessen's standard, and suggested that for work with nickel steels, &c., the bridge should be graduated in resistivities.

AN IMPROVED ELECTRO-MAGNETIC BUZZER.

The ordinary form of vibrating tongue for electric bells, &c., works on the principle of periodically opening the circuit automatically. For certain purposes, however—such as the operation of several instruments in series—a shunt circuit is arranged, which cuts out the electro-magnet as soon as the armature has been attracted. This method requires an excessive current, and in order to avoid this drawback the two arrangements shown in figs. 1 and 2 have been recently put on the market by Messrs. Siemens & Halske (Ammon's patent). In fig. 1, M is a horseshoe electro-magnet with two windings arranged bifilarly and connected, so that on first depressing the key T the battery B only sends current round one winding. This current attracts the armature, and an equal current then passes in the opposite direction round the second winding and so demagnetises the core, and the armature springs away again.

In fig. 2, two electro-magnets are employed in order to avoid the use of a spring, and the iron armature is balanced and lightly pivoted at *a*, so that it is free to come to rest in any position. On depressing the key T a current flows round M, and the armature is attracted and touches contact K. At this instant two additional

Fig. 1.



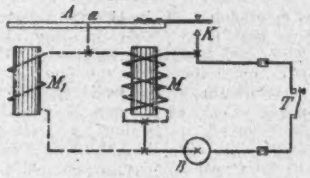


Fig. 2.

current paths exist—one round the second winding on M (which causes M to be demagnetised) and the other round M_1, which becomes magnetised and causes the armature to break contact at K. It is clear that the action will repeat automatically, in whatever position the armature may be, on switching on. The arrangement works satisfactorily with large or small currents, without adjustment and without sparking. This sparklessness is due to the fact that the two windings on M form a condenser bridging the spark gap.

LEGAL.

United Motor Industries *v.* C. A. Vandervell & Co.

We briefly referred to the opening of this case last week. Mr. Montagu Lush, K.C., and Mr. Hy. S. Macardie represented the plaintiffs; Mr. Hamilton, K.C., and Mr. Holman Gregory appeared for the defendants.

In opening plaintiffs' case, Mr. Lush explained that in 1901 the plaintiffs were selling dry accumulators, which they had been getting from Paris, but it was then mentioned to them that the defendants were making a useful ignition accumulator. Up to that time the dry battery had been used, and defendants' accumulators were the commencement of the ignition accumulators which had become so popular. Plaintiffs approached defendants. There was obviously a future for ignition accumulators, and the plaintiffs were desirous of building up a business in them. Their idea was to identify them with some name by which they would become known to the public, and by which it would be known that they could be got from the United Motor Industries, Ltd. They negotiated with defendants to make the accumulators and sell them exclusively to them, they, on their part, to build up a large business by extensive advertising. The accumulators were to be known by the name of the "Castle," plaintiffs selecting that name because their works were situated in Castle Street, and the negotiations eventuated in a written agreement, dated October 12th, 1902, whereby the plaintiffs during the year 1903 guaranteed to take not less than 1,000 accumulators from the defendants, who were to make them in a special form, with a specially designed plate and the word "Castle" moulded in a conspicuous manner. Defendants, on the other hand, were not to supply the same accumulator to any other firm whatever, or to supply accumulators of similar capacity to persons at a lower price than that at which they sold the "Castle" accumulators to plaintiffs. Defendants, however, were to be at liberty to make and sell accumulators providing they did not sell them as the "Castle." The United Motor Industries, Ltd., on their part, undertook to sell no accumulators as the "Castle" except those manufactured by the defendants as long as the quality was sustained and deliveries were adequate, and defendants undertook not to divulge that the "Castle" accumulators were made by them. It was anticipated that this would result in a very large business being done to the mutual advantage of the two firms. The word "Castle" was registered by the plaintiff company as the trade mark, and they spent very large sums indeed in advertising. The "Castle" accumulators thus acquired a good reputation in the trade, and the defendants, of course, knew that the real value in the business to the plaintiffs was that they became known to be the property of the United Motor Industries, Ltd. His (counsel's) contention, therefore, was that the words in the agreement by which defendants undertook not to divulge that they

manufactured the Castle accumulators meant that at no time was it to be lawful for them to suddenly publish to the trade that they had been making them. Defendants made and sold another accumulator, known as the C.A.V. accumulator. In order to prove that, although the written agreement extended over a single year only, defendants, who continued to make and supply the plaintiffs with the "Castle" accumulator, recognised and acknowledged that its terms were still binding upon the two firms, counsel referred to correspondence which ensued upon complaints by plaintiffs as to rumours which gained currency in the Midlands that defendants were the makers of the "Castle" accumulators. The defendants, he said, admitted that they supplied the plaintiffs under the agreement during 1903, but they asserted that since that year they had simply sold accumulators to the plaintiffs in the ordinary way of business, affixing the word "Castle" at plaintiffs' verbal request. In other words, they said that the obligation upon them not to divulge that they were the manufacturers lasted for one year only, and that afterwards they had liberty to do exactly what they choose. They did not take that view, however, in April, 1905, for they then wrote saying they had enjoined upon their representative in the Midlands to be careful not to say that the C.A.V. accumulators were identical with the "Castle" accumulators; and in May they altered the label of the C.A.V. accumulator in order that there might be no confusion. Harmonious relations thus continued between the firms down to July, 1906. For five years the plaintiffs had been advertising the "Castle" accumulators, and, having bound the defendants down not to divulge that they were the manufacturers, the business was theirs, and they were entitled to the benefit of the care they had taken, and the money they had expended, in building it up. On April 30th, 1907, however, the defendants advertised the fact that they were the manufacturers of the Castle accumulator as sold by the plaintiffs, that they were no longer supplying that firm, and that the same accumulator would be sold by them as the C.A.V. accumulator. That, counsel declared, was an absolutely flagrant breach of their undertaking, and was a deliberate attempt to try to take from plaintiffs the fruits of a long and successful effort to develop the "Castle" business. He asked the jury to say that the plaintiffs were entitled to succeed in their action, and to find a verdict in their favour.

Evidence was adduced in support of counsel's statement.

On Tuesday, July 9th, Mr. Hamilton, K.C., presented the case for the defendants. He said that the point for the determination of the jury was whether the transactions which took place between the parties after 1903 were attended by the restrictive term that the defendants were not to disclose the fact that they were the manufacturers of the "Castle" accumulators. The plaintiffs asked them to say that there was a renewal of the agreement, although there was not one word said about renewal, and although the two parties were dealing with one another simply in the ordinary way of maker and customer. For several years the United Motor Industries bought from Messrs. Vandervell what was admitted to be an excellent article; and they dealt to a large extent, and their friendly relations continued down to the end of 1906 or the beginning of 1907. At the end of 1906 Mr. Smith, the manager of the plaintiffs, learned that Messrs. Vandervell were selling, as they were entitled to do, his own goods, and had secured a contract to supply the Daimler Co. with coils. The plaintiffs thereupon commenced to manufacture their own accumulators at their works in Coventry, and to sell them under the name of "Castle." That was a breach of the agreement of 1902, if it still existed. In course of time Messrs. Vandervell found this out, and they asked the plaintiffs what they were to understand by it. They got an answer on April 18th, in which Mr. Smith, plaintiffs' manager, said:—"The sole reason why we made the change was because, rightly or wrongly, we felt there was another competitor springing up under our own eyes in a somewhat important branch of our business, viz., the coil business; and, whilst we fully recognise the right of the competitor to spring up and give us as bad a time as they are able, we do not feel justified in continuing to support that rival, or even to some extent to supply them with ammunition to fire at us. I can assure you this is absolutely the sole reason of our change." Having been cast adrift like that, and having acquiesced in it, because Messrs. Vandervell recognised that there was no agreement binding upon them at that time, defendants proceeded to advertise their own accumulators. It was most unreasonable to suggest that Messrs. Vandervell were to be bound by the agreement, and must not at any time divulge that they made the Castle accumulators, whilst the plaintiffs were to be at liberty to do just as they liked.

Mr. Justice Walton, in summing up on Wednesday, July 10th, said that plaintiffs contended that all orders given after 1903 were given subject to the terms of the agreement of 1902, that the defendants should not divulge that the accumulators were made by them; and defendants, on the other hand, said that all they undertook, at the most, was not to disclose the fact so long as their business relations continued. The jury, before finding a verdict for the plaintiffs, must be satisfied that there was an agreement, not necessarily in words and certainly not in writing, but which was understood by both parties that defendants bound themselves not to disclose at any time that the accumulators supplied after 1903 were made by them. If they thought the evidence was sufficient to establish such an agreement, then the defendants were liable, because after the business relations ceased they advertised the fact that they were the makers of the Castle accumulators. He, therefore, asked the jury to say whether there was an implied term that the defendants should not at any time, even after business had ceased between the parties, divulge that the accumulators were made by them.

The jury found that there was such an implied agreement, and they returned a verdict for the plaintiff, assessing the damages at one farthing.

His Lordship reserved judgment in order to hear arguments by counsel.

On July 11th, Mr. Lush, K.C., on behalf of the plaintiffs, claimed to be entitled on the finding of the jury to an injunction restraining defendants from further advertising themselves as the makers of the Castle accumulators, with costs.

Mr. Hamilton, K.C., contended that the jury's verdict meant that the action never ought to have been brought. It was not brought to vindicate any real wrong. He asked his Lordship to deprive plaintiffs of their costs, to require them to pay defendants' costs, and to refuse to grant the injunction.

His Lordship reserved judgment till Monday, when he said he thought the fair meaning of the verdict was that an action for damages ought not to have been brought, but he could not regard the action for an injunction as frivolous, and he thought the plaintiffs were entitled to judgment for their injunction, and one farthing damages, and that in the matter of costs, justice would be done to all parties if they had judgment with costs, except as to two-thirds of the cost of the trial.

United Incandescent Lamps and Electrical Co., Ltd. (Buda Pesth), *v.* Tanqueray.

In the City of London Court, on Friday last, an action was brought against defendant, J. T. Tanqueray, lately trading as the Wholesale Supply Co., Bond Street, to recover the sum of £24 for incandescent electric lamps supplied.

Mr. Edmondson, plaintiffs' counsel, said that they were represented by Mr. H. G. Mayer, the company carrying on business in Hungary. The defendant endeavoured to carry on an electrical business in the West-end of London under the name of the Wholesale Supply Co. He commenced in the early part of last year, and he had an "electrical department" there, according to his notepaper. Within a few months the defendant had ceased to carry on that business. Defendant wrote to the plaintiffs and discussed the purchase of 50,000 electric lamps of the mushroom shape. It was the defendant's desire to obtain a large supply, as he was appointing agents and was sending travellers with them throughout the length and breadth of England. He was to sell them at a price which would reserve to the defendant a liberal profit. In the course of certain negotiations which went on, the defendant asked if the lamps were the same as those certified by the Westminster Electrical Testing Laboratory. Mayer said he thought they were, but that he could not guarantee them without making inquiries. Considerable quantities of mushroom lamps were supplied, and they were sent to different parts of England. A large quantity of the lamps was returned because of the delay in the delivery. There was good ground for that complaint, because the time occupied in getting the lamps from Hungary was much longer than the plaintiffs imagined would have been the case. Plaintiffs took them back because other firms in Manchester were clamouring for them, and they had all since been sold. Defendant had complained that while the lamps were guaranteed to burn for 1,000 hours on low voltage, and 600 hours on high voltage, in many cases they only burned for a few hours. Defendant had said that he had many complaints. It was contemplated that the sale by the defendant would amount to 50,000 lamps for the first twelve months. A merchant at Hastings sent an order for 700 dozen lamps, and when they were delivered to the defendant's traveller in Hastings, he had gone. One merchant had sold as many as 330,000 lamps.

Mr. H. G. Mayer, 67, Aldersgate Street, plaintiffs' representative in London, said that when he first discussed the matter, he told the defendant that he had a certificate from the Westminster Electrical Testing Laboratory, to the effect that specimens of the lamps had been burned for 500 hours, and that they had burned satisfactorily according to the vouchers of Mr. Lancelot W. Wild, the chief electrician to the Electrical Testing Laboratories, Ltd. That certificate referred to the pear-shaped lamps, and not to the mushroom lamps.

In cross-examination, Witness admitted that he had been bankrupt, but he was discharged. The plaintiff company employed 7,000 people making incandescent lamps, electric motors and other electrical appliances. The mushroom-shaped lamps were a novelty, and he and the defendant were both anxious to push it. He guaranteed that the pear-shaped lamps would burn for 1,000 hours, lower voltage, and 600 hours higher voltage, but not the mushroom lamps. Defendant returned some of the lamps as bad, but one of them had been burning in his (witness's) office for 18 months, and was still good. They did not consume more energy than 3½ watts per c.p., and there was no ground for the suggestion that his lamps used an excessive amount of electric current.

The defence was a charge of fraud and misrepresentation, and that the orders for the lamps were only given because of the certificate. Mr. Tanqueray said that Mr. Mayer very distinctly told him that the certificate referred to the mushroom lamp, and not to the pear-shaped lamp. In consequence of the lamps being defective he had lost £75. He had raised a counterclaim for £112 for all the damage which he had suffered. Plaintiffs supplied him with hundreds of copies of the certificate, and he had sent them out to customers in all directions. That had brought him into great trouble in a business way. He employed twelve travellers, to one of whom he paid £4 a week.

Mr. Norman Knowles, an electrical expert, with 15 years' experience, said he had examined the lamps supplied by the

plaintiffs, and he found them defective. Quite 50 per cent. of the lamps tried went out before they had burned 600 hours.

In answer to the counterclaim, Mr. Max Hacker, of Manchester, said he had sold 300,000 of the mushroom lamps supplied by the plaintiffs, and he found them satisfactory, repeat orders following. None of them were faulty.

Mr. Alex. Dawson, electrical engineer, Rose Grove, Manchester, said he had also sold plaintiffs' mushroom lamps, for which he obtained a better price than any other.

The Jury stopped the case, and said they could not see that the defendant had suffered any damage.

Judgment was accordingly given for the plaintiffs on their claim (subject to formal proof before the Registrar of the delivery, &c.), and for the plaintiffs on the counterclaim, with costs.

The Attorney-General (Birkenhead Corporation) *v.* Mersey Railway Co.

The controversy between the Birkenhead Corporation and the Mersey Railway Co. as to the powers of the latter to run motor-omnibuses, which had already been before the Courts on several occasions, was before the House of Lords last week on an appeal from a decision of the Appeal Court of December, 1906. Their Lordships have unanimously allowed the appeal. The Lord Chancellor, in announcing this decision, said (according to the *Times* report) that the respondent company had been running a number of omnibuses in the town, and their justification was that the omnibus service was incidental to, and consequential upon, their railway system. It had been laid down in that house that a business which in itself would be *ultra vires* might be within the statutory powers of a railway if it were merely ancillary and incidental to the railway. This service of omnibuses, however, in his Lordship's opinion, was not fairly incidental to the railway enterprise. In substance it was an undertaking to enable the railway company to compete with the ferry across the river. The undertaking entered into in the Court of Appeal was impracticable, and could not be supported.

Whitaker *v.* Favell and the Nottingham Gas and Electric Fittings Co., Ltd.

At the Nottingham and Notts. Assizes last week, E. Whitaker, A.I.E.E., electrical engineer, Nottingham, claimed £500 from W. W. Favell, Rood Lane, London, and the Nottingham Gas and Electric Fittings, Co., Ltd., for damages in respect of breach of warranty in connection with coils of wire supplied for the purpose of an electric installation. There was a counter-claim for £32 odd for goods supplied. In opening the case for plaintiff, counsel said that in April of last year plaintiff's tender to install electric light in the Bentinck Hotel, Nottingham, was accepted by Messrs. Allsopp. Plaintiff gave the orders for material and wire to Messrs. Favell, and the supply of these went on from May until September. During that time defendant Favell, who had carried on business under the different names of the Nottingham Gas and Electric Stores and S. Haynes & Co., transferred it to the other defendants. On October 3rd the wiring was finished, but when the Corporation test was made defects were found. There were leakages in all directions. Some of the wires were taken out of their tubes, and the insulation tested, and it was found to be very weak indeed. Parts of the wire were then sent up to London for examination, and their resistance was found to be much less than it should have been, and much less than was stated on the guarantee labels attached to the coils. The owners of the Bentinck Hotel had claimed £96 14s. from plaintiff for labour of replacing coils and for loss of business. Plaintiff, in his evidence, said that no particular wire was specified in the contract. He did not test the wire when it came. It was not the custom to do so. There was nothing in its appearance to suggest that it was not satisfactory. He never used any other wire for the Bentinck Hotel than that supplied by defendants. According to a report in the local Press, plaintiff was cross-examined as to the method of putting the wire in. Mr. Neilson, counsel for the defendants, suggested that the proper way was to put the tubes in first and pull the wire through after the plaster had dried. Plaintiff said that that was not done one time out of ten. In the present case both were put in together. It was quite possible that wires might be damaged in being pulled out of the tubes. Plaintiff also said that of the 2,200 yards used in the installation only 440 yards had been re-installed.

Mr. F. H. Comport, mains superintendent, Nottingham, gave evidence as to the installation failing to pass the working test. The whole of the lighting had not yet been finally passed.

Mr. Herbert Talbot, city electrical engineer, had tested certain short lengths of wire submitted to him, and declared it absolutely useless for wiring premises for a pressure of 200 volts.

After other evidence as to the unsatisfactory result of the test, Mr. W. O. Hickson, the architect, explained that certain repairs were necessary owing to the defective installation.

Mr. Pollard, manager in Nottingham for Messrs. Allsopps, the owners of the hotel, said they took off a sum of £62 10s. from the tenant's rent in consequence of the disturbance of trade. They also claimed £16 for loss of profit.

Plaintiff's foreman, who did the wiring himself, testified to the efficiency of the work.

Counsel for the defence submitted that the wire was badly put in, and that it could not have been bad in itself. Large quantities had been made and sold without any complaint being received.

Mr. J. T. Mayfield, of Cannon Street, London, said he had had upwards of 30 years' experience in electrical engineering. There was nothing in the external appearance of the wire, which had been tested in London, to suggest that it had been damaged. He had himself tested coils of the same make and grade, and found them satisfactory.

Mr. A. E. Favell, director and manager of the defendant company, stated that plaintiff did not specify any particular cable for the contract for the Bentinck Hotel, and he was supplied with the same wire as he had been accustomed to receive from them. In cross-examination, the witness said the company procured the coils from the agent, a Mr. Strauss, and not the maker. He denied that they had mixed up any cables of inferior quality with the consignment obtained from the agent Strauss.

His Lordship said he was driven to the conclusion that the fault was in the actual wire itself, and not in the handling of it by plaintiff, or the condition of the premises at the time the installation was made. He gave judgment for plaintiff for £71 13s. 8d., and for defendants on the counter-claim for £32 6s. 8d.

PARLIAMENTARY.

Third Reading.—In the House of Lords on July 11th, the London United Tramways Bill was read the third time and passed.

Telegraph (Money) Bill.—In the House of Commons last Friday, this Bill, as amended in Standing Committee, was considered at some length. Mr. Bowles moved an amendment to provide that in any one year not more than £1,500,000 of the £6,000,000 should be spent. The Postmaster-General said that he could not accept the limitation, and it was rejected by an overwhelming majority. Mr. Cox moved the reduction of the capital sum to be authorised from £6,000,000 to £3,000,000. This also was rejected by a big majority, and the debate was then adjourned.

The Radio-Telegraphic Convention.—In the House of Commons on 11th inst., Sir E. Sassoon asked the Prime Minister whether he would consider the expediency of affording the House an opportunity for a debate on the report of the Select Committee. Sir H. Campbell-Bannerman thought that, as the Government had met the desire of the House by appointing a Committee of Inquiry, and as every opportunity had been afforded to the Committee for investigating the subject, they could not give any more Parliamentary time to it.

Communication with France.—It was stated in the House of Commons last week that the question of a reduction in the telegraphic and telephonic charges for communication between this country and France was now under examination; but there were difficulties, financial and other, so that the Postmaster-General could not at present make any statement on the subject.

Central London Railway Bill.—On Tuesday this Bill came before the House of Lords Committee (Earl of Onslow presiding), and was ordered to proceed. The Bill authorises the construction of a railway in the borough of Hammersmith, and of a subway at the Bond Street Station of the railway.

Richmond (Surrey) Electricity Supply Bill.—This Bill came on Tuesday before the Earl of Onslow's Select Committee of the House of Lords, and was ordered to go forward. The Bill authorises the company to carry out the undertaking of the Corporation in respect to the supply of electricity in the borough.

North Metropolitan Electric Supply Bill.—On Tuesday this Bill for the transfer of undertakings from companies and local authorities and the supply of current to railways, came before the House of Lords Committee (Earl of Onslow presiding) and was ordered to proceed. The Committee struck out the special clause granted by the House of Commons Committee to the Metropolitan Water Board in regard to electrolysis.

Liversedge Electric Lighting.—The Bradford Corporation have deposited a petition asking to be heard in opposition to the Liversedge Electric Lighting Order.

Bauxite in the Southern Parts of the United States.

—A report has recently been published by Mr. E. K. Judd, of the bauxite pits which occur along the valley of the River Coosa from Adairsville in Georgia, to Jacksonville in Alabama. This district is much less productive than that in Arkansas, where bauxite is mined, but the ore is much purer. The southern bauxites are found in irregular funnel-shaped pockets, which are from 200 to 500 ft. across at the surface, but less than 100 ft. wide at a depth of 75 ft. The bauxite is mined chiefly in three places, two in Georgia, and one in Alabama. At one particular mine the ore is so pure that 5 tons of bauxite are obtained from every 6 tons of the mineral. The hardest specimens of bauxite are sent directly to Niagara Falls for the manufacture of the artificial abrasive known as "alundum." The crude mineral is generally separated by a wet process into clay and bauxite, and the bauxite is then dried in a revolving tubular furnace fed with wood fuel. The best quality contains from 56 to 58 per cent. of Al_2O_3, and about 8 per cent. of SiO_2; the second quality contains 50 per cent. of Al_2O_3 and 12 per cent. of SiO_2; both grades containing less than 1 per cent. of iron. The hard varieties are said to contain less than 2 per cent. of silica.

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THE L.C.C. AND SURFACE CONTACT TRACTION.

Past proposals for extending the L.C.C. tramway system have so frequently involved a perpetuation of the costly conduit system, that one gives vent to a sigh of relief at the signs of awakening evidenced by the latest recommendation of the Highways Committee.

The consideration of a report by this Committee in reference to the matter, was postponed on Tuesday for a week, in accordance with the Council's standing orders.

The Committee's report states that in view of the large amount of tramway work remaining to be done, and the necessity for economy owing to the heavy financial commitments of the Council, it is essential to adopt a less expensive system except in cases where special circumstances make it necessary to use the conduit method. The Committee feel this to be very necessary, particularly in view of recent facts as to the difficulty of estimating the precise costs of the conduit system, owing to the impossibility of ascertaining in advance exactly what works are necessary in relation to the removal or alteration of underground pipes and mains. Having had before them information respecting various types of surface-contact systems, it appeared to the Committee that, generally speaking, the most satisfactory routes were secured with the G.B. method, which has been in operation at Lincoln for about a year, and which was inspected by them in May. Since then full reports had been considered in regard to the working results of the system, and also upon its merits compared with other surface-contact methods. The cars can be fitted with ploughs or with trolley arms in addition to the contact skates, so that arrangements can be made for through services of cars on the conduit or trolley tramways. It would be in the interest of the Council to lay an experimental line on the G.B. system, which is estimated to cost £10,500 per mile of single track, as compared with £17,000 for the conduit and £9,500 for the overhead trolley, these prices being exclusive of cables, &c. The route proposed for the trial is between Aldgate and the county boundary at Bow Bridge, a total length of about three miles of double line. The Committee have been in communication with the G.B. Surface Contact Co. as to the terms on which the company would be prepared to agree to the use of the system. The details are briefly as follows:—(1) The Council to pay to the company a royalty at the rate of £500 a mile of single line in respect of the reconstruction and working on the "G.B." system of traction of the existing horse lines in Whitechapel Road, Mile End Road and Bow Road; (2) the same royalty to be paid in respect of tramways constructed or reconstructed for this system up to a total length of 30 miles, including the Aldgate to Bow lines; (3) a royalty at the rate of £250 a mile of single track to be paid in respect of tramways so constructed or reconstructed beyond 30 miles and up to a total of 50 miles; (4) a royalty at the rate of £150 a mile to be paid on all lines on which the system is to be used beyond a total of 50 miles; (5) the royalty in respect of the Aldgate to Bow tramways not to be payable by the Council until 12 months after the opening of the lines for public traffic, and then only if the system works satisfactorily and the Council decides to retain it. The Committee have been in communication with Dick, Kerr and Co., whose tender was accepted last January for the roadwork and platelaying for the reconstruction of the tramways in Bow Road, between Coborn Road and Bow Bridge, as to the terms upon which they would be prepared to reconstruct the whole route from Aldgate to Bow on the "G.B." system. As a result this firm has submitted a tender amounting to £48,618 6s. 11d., which includes a provisional sum of £5,000. In addition, there would be a sum of about £3,000 for royalties at the rate of £500 a mile of single line which amount covers all patent rights involved in the use of the system, about £11,000 for rails, and £3,000 for the supply of special track work. This makes the total cost for the track work for the whole length of about six miles of line about £66,000, or £11,000 a mile of single track, compared with the cost of about £19,000 a mile which it is estimated would be involved by the adoption of the underground conduit system of traction from Aldgate to Coborn Road. It should, however, be borne in mind in considering these figures that, the difficulties on this particular route are exceptional, whether conduit or surface-contact traction is adopted, and the figures above referred to, therefore, are not a fair comparison of the respective cost of these two systems under normal conditions. It was originally intended to reconstruct the tramways from Aldgate to Cambridge Road on the underground conduit system of traction, and from Cambridge Road to Bow Bridge on the overhead trolley system of traction. The cost of the track work and overhead equipment, would, on this mixed system, have amounted to about £68,000, as compared with about £66,000 on the "G.B." surface-contact system. It should, however, in making this comparison, be borne in mind that the Stepney Borough Council has refused to consent to the overhead system between Cambridge Road and Coborn Road, and if the conduit system were also adopted on this part of the route, and overhead traction from Coborn Road to Bow Bridge, the figure of £68,000 above-mentioned would be increased to about £92,000, and the saving for the whole route by adopting surface-contact traction would be about £26,000. The Committee submit a number of recommendations which are intended to give effect to the proposals already set forth, the total expenditure amounting to £122,210, of which the sum of £13,850 is for cables and ducts and £50,000 for the erection of a car-shed at Bow.

The "G.B." is one of the most promising of the surface contact systems, as evidenced by its satisfactory performance at Lincoln. Whether it will prove equally satisfactory under the strain of London traffic conditions remains to be proved, but if its sponsors are given a reasonable chance, we have no doubt as to the favourable result in comparison with the conduit system, which everybody knows was costly to construct, but which we believe, as everybody does not know, is proving also very costly in the matter of upkeep and operation.

BUSINESS NOTES.

Trade Statistics of Japan for 1906.—The following statistics of the imports of electrical and other materials into Japan in 1906, have been taken from the Annual Trade Statistics of that country; the figures for 1905 have been added for purposes of comparison:—

	1905. Yen.	1906. Yen.
Electric Lighting Apparatus or Instruments.—		
From Germany	62,781	22,772
„ United Kingdom	105,217	127,223
„ United States	464,502	340,406
„ Other countries	156	83
Total	632,656	495,770
Electric Motors.—		
From Germany	166,774	184,540
„ United Kingdom	423,642	325,917
„ United States	1,859,748	861,928
„ Other countries	5,260	35,930
Total	2,455,424	1,408,315
Steam Boilers and Engines.—		
From Germany	55,957	41,250
„ United Kingdom	1,643,852	1,461,136
„ United States	894,223	646,697
„ France	21,703	642
„ Other countries	17,298	12,398
Total	2,633,033	2,162,123
Rails.—		
From Austria-Hungary	10,628	—
„ Belgium	130,782	281,232
„ Germany	337,343	1,035,924
„ United Kingdom	58,794	62,110
„ United States	403,811	829,820
„ Other countries	1,275	7,106
Total	942,633	2,216,192
Telegraph Wire.—		
From Belgium	146,620	41,692
„ Germany	942,908	845,314
„ United Kingdom	35,175	27,297
„ United States	81,338	220,888
„ Other countries	27	2,796
Total	1,206,068	1,137,987
Electric Cars.—		
From Germany	3,933	—
„ United Kingdom	250,221	49,231
„ United States	276,128	256,521
„ Belgium	316	—
Total	530,598	345,752
Electric Light Wire.—		
From France	918	21,094
„ Germany	60,729	19,246
„ United Kingdom	307,073	458,435
„ United States	391,009	328,295
„ Italy	281	2,583
„ Other countries	1,412	—
Total	761,422	832,353
Submarine and Underground Telegraph Lines or Cables.—		
From France	24,334	26,094
„ Germany	42,156	68,455
„ United Kingdom	2,502,408	102,663
„ United States	—	10,432
„ Other countries	276	—
Total	2,569,174	207,641

Yen = 2/0½.

Consular Notes.—ROUMANIA.—The Austrian Consul at Braila, in a recent report, states that electrical machines are imported almost exclusively from Germany; very small quantities are also imported from Hungary. Since the time of the installation of electric lighting, the importation of fine lamp wares, hanging and table lamps, lustres, &c., had decreased from 30 to 40 per cent. In the ordinary cheap lamps the demand is much the same, supplies being mostly from Bohemia. About 80 per cent. of the fine lamps come from Austria, but there is some trade in the better class table lamps made in Berlin. Austria-Hungary, France and Germany supply the ordinary electric lamps; lustres and other glass appliances are imported chiefly from Bohemia. Small electric lamps are supplied for the most part by Germany, as are also incandescent lamps. Nernst lamps and osmium lamps are imported exclusively from Austria-Hungary, and insulators, wire, &c., for the most part from Germany at fairly high prices.

SPAIN.—The British Consul at Bilbao reports that electric lighting in that town continues to extend. Even the villages in the interior are supplied with cheap lighting and power, being favourably situated in the vicinity of the many waterfalls which abound in the north of Spain. The Bilbao Co-operative Society increased their power plant during 1906, and now utilise four 800-KW. sets. Their machinery was obtained from Swiss and German firms. La Compania Electra, in order to compete with the Co-operative Society, have reduced their price to 50 cents (4d. per unit) and have also extended their cables to the villages and towns on both sides of the River Nervion—a distance of about 9 miles—thus competing with small local companies. A Franco-Spanish company has been formed at Irun, on the frontier, for the fitting up of a water-driven electric plant to supply cheap power to the south of France.

TURKEY.—The American Vice-Consul-General at Constantinople, in a recent report on the trade of Adrianople, states that an application for the supply of electricity which was made to the local authorities has been favourably reported upon. The Ministry of Public Works has, however, decided to invite tenders for the work.

JAPAN.—The British Acting Consul-General at Yokohama, reporting recently on the general trade of Japan, states that direct trade continues to increase, but it is still generally the safer policy to act through a British agent on the spot. Personal relations are especially important as a preliminary to dealings with Government departments, dockyards, &c. Foreign merchants are becoming more and more general merchants dealing in a wider variety of goods than formerly. Most of the large British firms, whose names may be ascertained at the Commercial Intelligence Branch of the Board of Trade, have a London office, where first inquiries might often be addressed with advantage. It is satisfactory to note the numerous visits of commercial travellers. This is a valuable method of acquiring necessary local knowledge, as merchants at home often fail to assimilate important information, however consistently it may be put before them in print.

Book Notices.—From the Manchester Section of the Institution of Electrical Engineers we have received a bound copy of the papers read at the meetings of the Section during the 1906-7 session. The discussions on these papers are also included. This is the first occasion on which such a volume of the sessions' work has been issued since the old Northern Society became the I.E.E. Local Section. Members of the Institution desiring to obtain a copy can do so for six shillings by writing to Mr. A. L. Green, the assistant secretary, at 2, Churchill Avenue, Manley Park, Manchester. The papers that are reprinted, together with the discussions, are as follows:—

"Chairman's Address." By T. L. Miller.
"Rotary Converters *versus* Motor-Generators." By Miles Walker, B.A.
"Cheapened Methods of Electrical Distribution." By J. H. C. Brooking.
"Magnetic Leakage and its Effect in Electrical Design." By W. Cramp.
"Large Gas Power Plants." By C. E. Douglas.
"Magnetic Oscillations in Alternators and their Bearing upon the Design." By G. W. Worrall.
"Some New Fly-wheel Storage Systems." By A. P. Wood.
"Breakdowns of Electrical Machinery." By L. Foster.
"A New Type of Induction Motor." By L. J. Hunt.
"The Experimental Determination of the Losses in Motors." By C. F. Smith.

"Annual Report of the Council of the City and Guilds of London Institute. 1907." London: Gresham College, Basinghall Street, E.C.

We tender to the proprietors and editors of the *City Press*—a paper which every man following the course of City affairs at all closely finds indispensable—our congratulations upon the celebration of the Jubilee of its foundation in the year 1857. To mark the event, our contemporary issued on Saturday last a special Jubilee number containing an eight-page illustrated supplement, in which appear a review of the history of the City Corporation, and a trade retrospect for the fifty years.

Outdoor Illuminations: Quick Work.—For the occasion of a garden party given last Saturday by Mr. Edgar Cohen in the grounds at 4, Hall Road, St. John's Wood, an electrical installation consisting of about 5,000 lights was installed by MESSRS. ROGER DAWSON, LTD. The work was carried through in only four days. Every lamp was alight all the evening, and not even a fuse went, although very wet weather was experienced during the time the wires were being installed. The job required a very large staff working day and night. Coloured lamps were fixed on all the big trees in the garden, and numerous beds, as well as the whole of the house, and all the garden paths, &c., were outlined in colours. A very large bandstand was erected for the band of the Coldstream Guards, and this was beautifully decorated, the decorations being assisted by over 400 coloured lights.

Annual Outings.—The annual outing of the LONDON ELECTRICAL FITTINGS CO., LTD., took place at Tilehurst on July 6th. There was considerable attendance, and a most enjoyable day was spent.

The staff of the GUILDFORD ELECTRICITY SUPPLY CO., LTD., held their annual outing on Wednesday, the 10th inst., when a trip was made up the river to Windsor. The party went by train to Walton-on-Thames, where they embarked on an electric launch for Windsor. Dinner was partaken of at the White Hart Hotel, Windsor, the staff being joined by several guests. After dinner, visits were paid to Windsor Castle and other places of interest in the neighbourhood.

The workmen of the Electricity and Tramways Department of Newport (Mon.) held their annual outing on Saturday last, Portsmouth and the Isle of Wight being visited. After looking over the Government Dockyard, the party crossed the Solent to the Isle of Wight, and partook of dinner at the Salisbury Hotel. In the absence of Mr. H. Collings Bishop, the borough electrical engineer and tramways manager, Mr. J. G. Ellis, the secretary of the electricity and tramways department, presided.

The annual outing of the employés of MESSRS. STEGMANN & CO., of Clapham Junction, took place on 6th inst., to Brighton, where the company, numbering about 50, were favoured with good weather. Mr. Stegmann met the party at the dinner, which was partaken of at the "Queen."

The first annual beanfeast of the staff and employés of MORRIS-HAWKINS, LTD., took place on Saturday, July 13th. The *Koh-I-Noor* conveyed the party to Margate, where a very enjoyable day was spent.

The annual outing of the staff of the SUN ELECTRICAL CO., LTD., took place on Saturday last in the form of an up-river trip to Hurley. The electric launch *Flosshilde* left Maidenhead Bridge at 10·30 A.M., luncheon being served at the "George and Dragon" Hotel, Marlow. Mr. A. G. Beaver, the manager, occupied the chair. The party then continued the journey to Hurley, tea being partaken of at "Ye Olde Bell."

Roumania.—The Board of Trade have received a copy of a recent Roumanian Customs Circular directing that electric cables sheathed with sheet-iron, iron-wire or bands, shall be dutiable at the rate of 12 lei per 100 kilogs. under No. 750 *(a)* of the Tariff, even if also protected with jute or other common materials. —*Board of Trade Journal.*

Exhibition: Correction.—The Loughborough Corporation Electrical Exhibition, to which we made reference in our last issue, is to open on September 16th, not the 10th.

Catalogues.—THE ARMORDUCT MANUFACTURING CO., LTD., of Farringdon Avenue, E.C., in a publication that they have just placed in circulation, give a description of their "Blase" flame arc lamps for direct and alternating current, the construction of which is claimed to be simplicity itself. Full instructions for installation and trimming are given. Prices, sizes, code words, &c., are stated in tabulated form, as are also prices of Conradty's Norris-Excello arc lamp carbons, arc lamp accessories, and so forth. Enclosed lamps of various types are included in the list.

MESSRS. LUDW. LOEWE & CO., LTD., Farringdon Road, E.C.—Second edition of their "Notes on Foundry Practice," a 30-page pamphlet. Special attention may be directed to their electric resistance grids, which are described, and some particulars of tests which they have been subjected to and have stood successfully. Any of our readers interested in the subject can have a copy of the publication on application to the above address.

MESSRS. THOMAS PARKER, LTD., Wolverhampton.—Eight-page pamphlet containing an illustrated specification descriptive of their Rees "Roturbo" patent self-regulating centrifugal pumps, with characteristic curves.

UNION ELECTRIC CO., LTD., Park Street, Southwark.—List No. 1,006, relating to their direct-coupled steam-driven dynamos of small size ranging from 3½ to 56 KW. output. Open and enclosed type vertical high-speed engines are described, and prices are tabulated. Mechanical and electrical details of dynamos are also given, as well as particulars and prices of switchboards suitable for use with the generators.

THE AUTO-CONTROLLER AND SWITCH CO., Vienna Road, Jamaica Road, Bermondsey, S.E.—Circular relating to their Fluxite soldering paste for various kinds of electrical work. We have also received a sample of the paste.

MESSRS. THOMAS BROADBENT & SONS, LTD., Central Ironworks, Huddersfield.—Illustrated pamphlet (14 pages) containing a description of their tramway-type controllers and resistances and their construction, together with price particulars of same. The firm have specialised in this line, and have put down new plant therefor. The design is the result of many years' experience, and the controllers are claimed to embody all modern improvements. The construction is from non-inflammable materials, no wood or vulcanised fibre being used, and mica insulation is utilised wherever possible. In the resistances, which are of substantial construction and liberally rated, special attention is given to the insulation, and it is stated that the parts are unaffected by vibration.

MESSRS. D. SANTONI & CO. (1906), LTD., London, E.C.—New leaflet (No. B 3) giving illustrations and lists of prices of water-tight oyster fittings, cargo lights, &c.

MESSRS. ROYCE, LTD., Trafford Park.—Illustrated leaflet relating to their totally enclosed marine-type motors fitted with ball bearings.

Messrs. E. Bennis & Co., Ltd., have issued a batch of eight single-page circulars illustrating their stokers and coal-handling plant actually installed and in operation. One of the circulars shows the new patent chain-grate with the close links and without a dumping bar; it also shows the firm's tippler and inclined conveyor which obviates trimming while expeditiously emptying every ounce of coal. Another leaflet bears testimony to the efficacy of Bennis plant. Any reader interested in these matters can have copies of the lists by applying to Little Hulton.

Clock Tower Lighting.—The new Clock Tower at St. George's Circus, S.E., which has recently been erected by Messrs. Faulkner, tobacconists, to replace the Obelisk which was originally erected at that spot by Alderman Crosby, was declared open by the Lord Mayor of London on Tuesday. The tower is illuminated at its four corners by Excello arc lamps, controlled as to the time of lighting and extinguishing by the clock mechanism.

Condensing Plant.—Among the contracts recently received by The Mirrlees, Watson Co., Ltd., of Glasgow, are the following:—One from Franco Tosi for three sets of surface condensing plant, duty each 20,000 lb. steam per hour; one from Fraser & Chalmers, Ltd., for two surface condensers, each 3,200 sq. ft. cooling surface; and one from the Lancashire and Yorkshire Railway Co., Horwich Works (per W. H. Roy & Co.) for one counter-current jet condensing plant, duty 50,000 lb. steam per hour.

Exhibition.—An "Exhibition of Materials" was inaugurated at Venice on July 7th, which will continue open for some time. After the opening ceremony the Royal Party immediately visited the stand on which were shown the various British-made exhibits of the Edison & Swan United Electric Light Co., Ltd., of London, E.C. We are informed that the Queen Mother personally expressed her pleasure with the exhibit of useful and ornamental electrical appliances, and desired that her satisfaction should be made known to the makers. The Exhibition is proving a great success, and has been visited by a number of the Italian aristocracy.

Bankruptcy Proceedings.—C. W. Stafford (Stafford Bros.).—At Dudley on July 12th bankrupt was examined. The accounts showed liabilities amounting to £292, and a deficiency of £164. The examination was closed.

Clifton Robinson, "of no occupation," of Queen's Gardens and Porchester Gate.—At the Bankruptcy Court on 9th inst. this public examination was held. The accounts filed showed liabilities £35,968 (£34,790 unsecured) and assets £264. Debtor said that he was the son of Sir J. Clifton Robinson, managing director of the London United Tramways Co. On attaining his majority in August, 1901, his father settled for his benefit funds upon trust which produced an income of £1,000 a year. Prior to that he had been appointed superintendent of a tramway company at a salary latterly of £300 a year. That appointment he had resigned. His failure was due to extravagance, losses by betting, and Stock Exchange speculations. The examination was concluded.

A. H. Dodd & H. J. A. Whateley (Garrick Electrical Co., Walsall Street, Bilston).—First meeting, July 24th; public examination, July 31st—both at Wolverhampton. The Official Receiver on Tuesday issued a statement of affairs. A summary of the debtors' partnership statement shows gross liabilities £36, of which £32 is expected to rank for dividend; and there is an estimated deficiency of £21. The causes of insolvency, as alleged by bankrupts are insufficient capital, bad trade and competition.

Trade Announcements.—Mr. D. C. Bate, A.M.I.C.E., announces that having severed his connection with the Electric and Ordnance Accessories Co., Ltd., he has opened an office at 40, Brazennose Street, Manchester, as a manufacturers' agent. Mr. Bate has agencies for dynamos for motors, both D.C. and polyphase, main switches, switchboards, measuring instruments, and telephones. In the course of his lengthy connection with the electrical industry in this country, he has made many friends, all of whom will join with us in wishing him every success in his new sphere of operations.

Mr. Alfred S. Mumme, of 95, Leadenhall Street, E.C., has been appointed sole London representative for Messrs. R. S. Newall and Son, Ltd., wire rope manufacturers, Liverpool; also for Messrs. Storry, Smithson, & Co., Ltd., Hull, makers of the "Economic" anti-fouling compositions.

Messrs. J. C. Lyell & Co., Ltd., have just been appointed sole buying agents by Messrs. C. and T. T. Pattison, torpedo boat builders, motor-car builders, and general mechanical and electrical engineers, of Naples, Italy. Messrs. Lyell will welcome catalogues and price lists (in duplicate) and export discounts, from manufacturers and agents for tools, plant, boiler plates, machinery, materials, &c. Owing to increased business with the Continent, the firm have now opened an office at 84, Rue de Richelieu, Paris.

Messrs. British Insulated and Helsby Cables, Ltd., inform us that they have opened a branch office at 17, Crow Street, Dublin, in charge of Mr. F. H. Jones.

Mr. S. P. Marsh, electrical engineer, has opened new business premises at 5, Castle Buildings, Castle Street, Rugby.

Messrs. McPhail & Simpson, Ltd., of Wakefield, have purchased the business of the late firm of McPhail & Simpson's Dry Steam Patents Co., Ltd., together with the goodwill, patents, machinery, plant and tools, but not the liabilities or outstanding accounts. The business will as hitherto be conducted under the personal management of Mr. McPhail.

The businesses of the Amalgamated Batteries, Ltd., and the Universal Battery Co. have, as from 1st inst., been consolidated, and will, in future, be carried on, under joint management, in the name of The Associated Battery Co., Ltd., at the Mid Kent Works, Penge, S.E., where all correspondence should in future be addressed. Telegraphic address—"Unibaco," London. Telephone No.—166 Sydenham. For the purpose of carrying out this arrangement, the Amalgamated Batteries, Ltd., is now being wound up voluntarily, and the whole of its assets, including the stock and plant, the cash balance, after payment of outstanding liabilities, and the uncalled-up capital, will be taken over by the new company. Mr. C. H. Elliot, who for about 16 years has been head of the Universal Battery Co., will retain the management of the combined undertaking.

Dissolutions and Liquidations.—The Electric Safety Appliances Co., Ltd.—This company is winding up voluntarily, with Mr. H. A. Grimsdick, 82, Victoria Street, Westminster, as liquidator.

British Electric Separating Co., Ltd.—A meeting is to be held at Swansea on August 13th to hear an account of the winding up from the liquidator (Mr. J. F. Harvey).

Norman McKenzie & Co., electrical and mechanical engineers, Chatham.—Messrs. Norman McKenzie and W. T. Wright have dissolved partnership. Mr. Wright will attend to debts and continue the business as Walter T. Wright & Co.

Kuettner, Macdonell & Cookson, Ltd.—This company is winding up voluntarily, with Mr. A. W. Sully, 19-21, Queen Victoria Street, E.C., as liquidator.

Chatham, Rochester and District Electric Lighting Co., Ltd.—This company is winding up voluntarily, with Mr. C. T. Smith, Violet Hill, Borstal Road, Rochester, as liquidator, to whom particulars of debts, &c., should be sent by August 16th.

May-Oatway Fire Appliances, Ltd.—This company is winding up voluntarily for purposes of reconstruction, with Mr. E. W. Elliott, 22-26, Paul Street, Finsbury, and Mr. C. A. Underwood, Threadneedle House, E.C., as liquidator. A new company is to be formed with the same name.

Capilliform Telegraph Instrument Co., Ltd.—This company is winding up voluntarily with Mr. H. Clough, 54, Gresham Street, E.C., as liquidator.

De Forest Wireless Telegraph Syndicate, Ltd.—This company is winding up voluntarily with Mr. W. L. Davis, 601, Salisbury House, E.C., as liquidator. Creditors should send particulars of debts, &c., to him by August 31st.

Sirocco Fans.—We are informed that the German Superior Court last week gave a decision upholding S. C. Davidson's patent for Sirocco centrifugal fans.

LIGHTING and POWER NOTES.

Ashton-under-Lyne.—A L.G.B. inquiry was held on July 11th, relative to the application of the T.C. for a loan of £27,500 for electricity purposes. There was no opposition.

Belfast.—Owing to the labour troubles here, the coal supply is getting very low at the electricity station, and a crisis must come shortly. Some firms have given notice of a close down at the end of the month in anticipation of a failure of the electric power supply.

Birtley.—The P.C. has asked the County of Durham Electric Power Distribution Co. to quote terms for public lighting by electricity.

Bradford.—The accounts of the Corporation Electricity Committee for the year ended March 31st last, show a gross profit of £57,926, as compared with £51,033 for the previous year, and a net profit, after paying interest and sinking fund, of £4,451 as against £3,985 for the previous year. The income was £107,037, as against £98,096 in the preceding 12 months. The increased working expenses were £2,049, and the increased interest and sinking fund payments amounted to £6,427. The sum of £5,000 has been transferred to the reserve and renewals account.

Bury.—The *London Gazette* for July 12th contains notice of the terms of a proposed transfer of the R.D.C.'s electric lighting powers (1905) to the Lancashire Electric Power Co.

Carmarthen.—By 12 votes to 10 the T.C. has decided to proceed with the E.L. scheme submitted by Messrs. J. B. Saunders and Co. The maximum price of electricity is to be 7d. per unit, and it is to be available within 18 months of the order being obtained.

Darlington.—The T.C. on July 11th decided not to entertain an offer from the Cleveland and Durham Electric Power Co., to supply electricity in bulk, as the Council is quite capable of meeting the local demands at the present time.

Dunfermline.—As a result of the expert advice favouring negotiations with the Fife Electric Power Co. as to a bulk supply in the town, an endeavour is being made to obtain final terms from the company. Much local opposition to the company appears to exist.

Farnborough.—The U.D.C. has received an intimation that prov. orders for E.L. are being applied for by the Woking Electric Supply Co., Ltd., and the Mutual Electricity Supply Co., Ltd.

Keynsham.—The P.C. has accepted the tender of Messrs. Parfitt, Webber & Co., electrical engineers, Bristol, for public lighting with 126 lamps, from August 10th to May 10th, for £262.

Hinckley.—Mr. C. S. Vesey Brown, of Newcastle-on-Tyne, has informed the R.D.C. that he intends applying for a prov. order for E.L. in the parishes of Barwell, Burbage, Earl Shilton, Stoke Golding, Stoney Stanton and Sapcote.

Knottingley.—At the meeting of the U.D.C. on July 11th, notice was received of the intention of the Electrical Distribution of Yorkshire to apply for a prov. order for E.L. The proposed tariff is 4d. per unit for private lighting, and 2d. for public purposes.

Lichfield.—The T.C. has decided to apply to Messrs. Foote & Milne for the payment of the costs of the Council's E.L. order, 1901, which, under agreement, were to be paid within two years from the commencement of Foote & Milne's E.L. order, 1905.

London.—Lambeth.—At the meeting of the B.C. on Thursday of last week, the General Purposes Committee reported that two meetings had taken place between representatives of the B.C. and the South London Electric Supply Corporation with a view to settling the differences between the two bodies, and so prevent the further continuance of expensive litigation with regard to the company's undertaking as to dust destruction. It was eventually agreed that the company should give to the B.C. free light (not power) to the extent of £1,000 a year at the price of 3½d. per unit in public buildings so long as the order is held by the company or its assigns; the company to wire (with fittings) the Council's libraries or other public buildings (excepting the Town Hall and baths), making up the £1,000 a year; (3) the company to pay £300 towards the Council's out-of-pocket costs of the actions.

St. Pancras.—The annual statement of accounts of the electricity undertaking has just been issued, and from this it appears that the gross income for the year ended March 31st amounted to £74,513, an increase of £2,427 as compared with the previous year. £61,376 was received from sale of current, as compared with £59,997; and £10,733 from public lighting, as compared with £10,048. The total expenditure for the year was £43,495; this left a balance of £31,018, and after paying interest on mortgage debt, on bank overdraft and consumers' deposit account, instalments of loans and allowances for bad debts, there was a net profit of £6,495, which the Committee recommended should be carried forward in the net revenue account as a working balance. Last year the net profit was £9,441. The number of consumers has increased during the twelve months from 2,763 to 2,921.

Penzance.—The B. of T. has written to the T.C. intimating that as the company possessing the powers under the E.L. order has not complied with the requirements of the order, it is proposed to revoke it.

Plymouth.—The B. of G. has definitely decided to have the new infirmary wired for the E.L. A Committee had recommended that gas alone be laid on at a cost of £438, but an amendment that electricity and emergency gas fittings be provided at a cost of £442 was carried by 18 votes to 8.

Runcorn.—The Warrington T.C. has informed the R.D.C. that it intends to apply for a prov. order for E.L.; the matter is under consideration by the authorities concerned.

Sunderland.—A L.G.B. inquiry was held last week into the application of the T.C. for a loan of £58,967 for electricity purposes. There was no opposition.

Swanage.—Messrs. Foote & Milne have informed the U.D.C. that they intend applying to the B. of T. for a prov. order for E.L.

Swinton and Pendlebury.—The U.D.C. has decided to supply energy to persons whose premises are outside the 50 yds. limit on a two years' contract, on condition that the total payment for the supply shall not be less than 20 per cent. on the outlay in providing additional electric lines.

Westgate-on-Sea.—A private company has informed the P.C. that it intends applying to the B. of T. for a prov. order for E.L.

Wexford.—A provisional order for an electrical lighting scheme for this town is being applied for in the usual course.

Whitehaven.—The T.C. has decided, with a view to popularising the use of electricity for lighting, to give one month's free supply of electricity to new consumers connected by August 30th, and a fortnight's free supply to those connected between August 30th and the middle of September.

TRAMWAY and RAILWAY NOTES.

Belfast.—A deputation from the Cavehill and Whitewell Tramway Co. has requested the Tramways Committee to give permission for the company's cars to run over the Corporation's lines as far as the Castle Junction, pending the acquisition of the former by the Corporation. The request was refused.

Brighton.—The receipts of the Corporation tramways, for the year ending March 31st last, amounted to £50,653; the working expenses amounted to £34,499, and after meeting financial charges a net profit remained of £2,410, which compares with £1,615 in 1905-6. Although the revenue shows a decrease, the working expenses are less in proportion than in the previous year. The car-miles run were 1,118,590, and the passengers carried 10,759,310; both these showing a decrease on 1905-6—the policy of the department being to curtail non-paying traffic.

Bury.—In his annual report on the tramways, Mr. William Clough (general manager) states that the total number of passengers carried on the Bury sections (that is, excluding Radcliffe and Heywood) was 6,157,759. The working expenses per car-mile, exclusive of power, were only 3·69d., whilst the total working expenses, inclusive of power, were 5·536d. The net profit on the year was £5,225, of which £2,500 had been carried to reserve depreciation fund account, and the remainder to the borough rates. The capital expenditure to date is £242,466. On the Radcliffe sections the net receipts were £3,374, which did not meet the working and other expenses.

Continental Notes.—Spain.—The British Consul at Cadiz reports that the extension of the tramway to Chiclana, Tarifa and Algeciras is now under consideration. The main difficulty lies in obtaining permission for the construction of a bridge at San Fernando, in the place of the present bridge of boats.

Berlin. — At the present time the Berlin Elevated and Underground Electric Railway Co. owns and works a high and low level line from the Warschauer Brucke in Berlin to the Wilhelms Platz, in Charlottenburg, with branches to the Potsdamer Platz, of a total length of 7·68 miles, together with a surface line from the Warschauer Brucke to the Central Vichhof, of a length of 1·36 miles. Extensions are now in progress in a westerly direction to the Reichskanzler Platz in the west-end, and from the Potsdamer station into the interior of Alt Berlin, as far as the Spittelmarkt. The opening of the former for traffic is to take place next April, whilst the latter is expected to be completed in 1909. The concession for these extensions, as in the case of the original railway mileage, extends to 1987. Apart from the payment to the town of a minimum tax of 2 per cent. of the gross revenue, the company is under obligation to pay for the extensions one-half of the net receipts which exceed the amount of 6 per cent. of the capital invested in these particular sections. The entire undertaking will revert to the town free of charge on the expiration of the concessions in 1987, but it is possible for the municipal council to acquire the railway at an earlier period by purchase on terms which were agreed upon some time ago. An increase of £500,000 in the company's share capital, to £2,000,000, was made last December, and a fresh issue of £500,000 in 4 per cent. bonds, bringing the total bond issues up to £1,250,000, has just been made to provide for the expenditure incurred in the carrying out of the extensions already mentioned. The bonds have no mortgage claim on the undertaking, and are redeemable at a slight premium as from 1912. The rolling stock comprises 72 motor coaches and 52 trailers.

Leeds.—A member of the staff of the Leeds Tramways Department has devised a new brake which is to work either electrically or mechanically, is applied entirely to the track, and is stated to be fool-proof. Major Pringle witnessed a test at Leeds on Saturday on behalf of the Board of Trade. The Leeds conductors and drivers are demanding a fifty-four hours' week without any reduction of wages.

London.—L.C.C.—The General Purposes Committee, at the meeting of the L.C.C. on Tuesday, presented a long report in regard to locomotion and transport in London, and to a suggestion as to the appointment of a Traffic Board. The report gives an historical account leading up to the appointment of the Royal Commission, and a synopsis of the latter's report, and refers to the reception of a deputation this month to urge the Council to approach the Government with a view to the establishment of a Traffic Board on the lines recommended by the Commission. As a result of a careful consideration of the subject, the Committee stated that they felt that the establishment of an authority competent to deal with the question in London was desirable, although they were not at the moment prepared to express any opinion as to the precise constitution of such an authority. The Committee were supported in that conclusion by the circumstance that the President of the Board of Trade recently made it evident that the Government were not opposed to the suggestion of the Royal Commission, but were, in fact, alive both to the importance and urgency of the problem. The Committee, therefore, recommended that they should be authorised to arrange for a deputation to wait upon the Prime Minister to urge the necessity of the Government securing the immediate establishment of a Traffic Board as indicated by the Royal Commission. Sir J. W. Benn asked that, having regard to the importance of the subject, further time should be given for the consideration of the report. Captain Swinton, in reply, stated that the Progressives had had two years to consider the matter, but they had done nothing. He was, however, prepared to postpone the report for a week, and this was agreed to without discussion.

Elsewhere in this issue, we refer to the far-reaching proposals of the Highway Committee, to lay 3 miles of route, from Aldgate to Bow on the "G.B." surface-contact system. Neither the conduit nor trolley systems were practicable on this route, and the great saving in expense and adaptability of the "G.B." system have led to its recommendation.

London United Tramways.—Upon the initiative of the Ealing T.C., a conference is to be held on the 25th inst. at Ealing upon the subject of the noise of the electric trams in the district served by the company. All the localities through which the lines run will be represented.

Electro-'Bus Service.—The electro-'bus service in London now consists of six vehicles; three of these have been running for some time, and three additional 'buses have now been placed on the Liverpool Street to Victoria route. Eventually it is intended to place 50 vehicles on the streets.

Richmond (Surrey).—The T.C. has recently discussed a proposal in favour of the creation of a system of municipal tramways. The proposal was to lay lines from Barnes and Mortlake into the borough and over Kew Bridge connecting with the London United Co.'s system. In the course of the discussion, it was stated that the Traction Development Co., and also the Richmond Electricity Corporation had offered to lease and work the orders or Acts when obtained. The motion was adopted by 12 votes to 11.

Wallasey.—The report on the tramways for the past year shows considerable improvement over preceding years. The undertaking includes only 8 miles of route on the popular Cheshire side of the Mersey. The receipts for the 12 months amounted to £43,608 (over 1s. per c.m.), and after deducting working expenses (7¼d. per c.m) the surplus was allocated as follows:—Interest, £5,157; sinking fund, £2,337; depreciation, £3,000; sundry, £452; leaving a net balance of £5,292. Including balances in hand, £1,952 was carried forward and the remainder voted to the rates. Nearly 8 million passengers were carried and 862,000 c.ms. run; the percentage of working expenses to receipts was 62 per cent.

West Ham.—The revenue of the tramway undertaking for the past year amounted to £119,775 (11·2d. per c.m.); working expenses absorbed £72,419 (6·79d. per c.m.), leaving a net balance of £47,356. After providing for all financial charges, allocating £7,722 to renewals and transferring £9,668 to the rates, there remained a surplus of £4,322, which was carried forward. Some 2½ million car-miles were run, and 35½ million passengers carried during the year, the percentage of working expenses to receipts being 60. Through-running is being carried on between West and East Ham and Leytonstone.

Willesden.—In response to a largely-signed petition from the inhabitants of Willesden Green, the Metropolitan Railway Co. has signified its intention of erecting an additional station on the Harrow electrified line about midway between Willesden Green and Neasden.

TELEGRAPH and TELEPHONE NOTES.

Melbourne-Sydney Telephone.—The *Daily Chronicle* Melbourne correspondent says that the Sydney-Melbourne telephone, 600 miles long, has been opened amid universal congratulations. "The line is calculated to lessen inter-State friction."

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Cayenne-Pinheiro	Aug. 13, 1902 ..	..
Curacao-Coro Curacao-La Guayra } Closed.. Curacao-Maracaibo	Jan. 12, 1906 ..	..
Reissa-Issa and Reissa-Yemani (Yemen) ..	Oct. 22, 1902 ..	..
Tarifa-Tangier	Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed)	Mar. 9, 1904 ..	..
Garachico-Santa Cruz	July 12, 1906 ..	..
Las Palmas-Arecife	Aug. 18, 1906 ..	..
Trinidad-Demerara	July 8, 1907 ..	July 14
Burwick-Thorshavn	July 8, 1907 ..	July 13
Landlines.		
Puerto-Barrios	Aug. 2, 1909 ..	..

Wireless Telegraphy.—The *Financial News* says that the Dutch Indian Government has granted to a syndicate a concession for establishing a wireless telegraph system between Java, Celebes, Borneo, and the neighbouring islands. The company, with a capital of 2,650,000 fl., is now in the course of flotation, but there will be no public issue.

Electrical Engineers (Volunteers).—A correspondent writes that the adjutancy of the London Division Electrical Engineers (Volunteers) will be vacant shortly, and the War Office is seeking a Royal Engineer officer to fill the appointment, in succession to Captain W. C. Dumble, Royal Engineers.

On Saturday the officers and men of the Mersey Division Royal Electrical Engineers (Vols.), numbering about 150, entered upon their annual camp at Wallasey, Cheshire. By permission of Col. G. F. Allender, the parade was at the headquarters of the 1st V.B. Liverpool's, from whence they marched to the landing-stage, headed by the band of the 1st Lancashire R.E. (Vol.). The division was under the command of Col. H. Langdon, V.C. (commanding), with whom are the following officers:—Major J. H. Jones, Capt. A. H. Jones, Capt. W. F. Price, Capt. T. R. Wilton, Lieut. A. C. Mitchell, Lieut. J. W. Shaw; the Rev. J. Baines, V.C., chaplain; and Capt. and Adjt. E. T. H. Hetherington, R.E.

CONTRACTORS' COLUMN.

Openings for New Business.

ALTRINCHAM.—Higher Elementary School for Altrincham, Bowdon, Hale and Timperley. Competition designs sought by the Cheshire Education Committee.

ANNFIELD PLAIN (Co. Durham).—New Council school (accommodate 300) and enlargement of infants' school. County Education Committee's architect, Shire Hall, Durham.

ASTON MANOR.—Electricity sub-station, &c., at Six Ways, Erdington, for the T.C. Borough surveyor, Aston Manor.

BALLYBAY (Co. Monaghan).—Steam bakery in Abbey Street.

BANBURY (King's Sutton).—New public schools (£4,000).

BARROW (Walney Island).—Church (St. Mary's, £2,500). Paley & Austin, architects, Lancaster; Messrs. Troms, builders, Lancaster.

BELFAST.—New cotton mill, Springfield Road (£8,000). W. Dowling, contractor; S. Stevenson, Royal Avenue, architect.

BILLERICAY.—Maternity ward and consumptives' hospital at the workhouse (£1,950).

BLACKBURN.—New Primitive Methodist Sunday Schools. J. T. Henshaw, architect, 155, Preston New Road, Blackburn.

BOLTON.—New theatre. T. Hargreaves, Theatre proprietor, Rochdale.
Baptist Church. Potts, Son & Hennings, architects, St. George's Road, Bolton.
Workshops in Thynne Street, for D. and E. Maginnis, joiners and builders.
Workshops for T. Cooper & Son, timber merchants.
Warehouse in Queen Street, for J. Perry, Ltd.

BROMSGROVE.—Extensions to Barnsley Hall Asylum for the Worcestershire C.C. A. B. Rowe, architect, Worcester Chambers, Worcester.

BUNDORAN (Ireland).—Additions to the Female Orphanage. T. F. McNamara, architect, 50, Dawson Street, Dublin.

CHESTER (Broughton).—New church schools. Willink & Thicknesse, architects, 14, Castle Street, Liverpool.

CRAMLINGTON (Northumberland). — Public elementary schools (680 scholars). C. Williams, secretary to the County Education Committee, Pearl Buildings, Newcastle-on-Tyne.

DARLINGTON.—Important extensions to the High School for Girls for Durham C.C. J. A. L. Robson, secretary for Higher Education, Shire Hall, Durham.

DARTFORD.—County school for girls to be built by Kent C.C.

DERBY.—Hospital at Over Haddon (£5,000).

DEVONPORT.—New theatre in Princes Street (£20,000).

DIPTON (Co. Durham).—New Roman Catholic schools at Bradley Lodge. G. T. Wilson, architect, 22, Durham Road, Blackhill (Co. Durham).

DRUMCOLLOGHER (Ireland).—Improvements to Drumcollogher church. B. E. F. Sheehy, 57, George Street, Limerick, architect.

DUBLIN.—Alterations and additions to Mercers' Hospital. A. E. Murray, architect.
Additional wing to the House of Retreat, Milltown Park. J. P. Wrenn, 16, Nassau Street, Dublin, architect.
Four semi-detached villas for Mr. McDermott, 13, Nassau Street, Dublin. W. Callan, Leinster Street, Phibsborough, builder.
(Cork Street).—Dry cleaning and finishing rooms for Eustace Bros. H. J. Lundy, architect; A. Hull & Co., Ringsend Road, Dublin, contractors.

DUDLEY.—Pupil Teachers' Centre, to be built by the T.C.

DUNDALK (Co. Louth).—Additions to St. Mary's College for the Marist Fathers. T. F. McNamara, architect, 50, Dawson Street, Dublin.

DURHAM (Sacriston).—Co-operative Stores. Mr. Norman, builder, Chester-le-Street.

EASTBOURNE.—Elementary and cookery school (£5,958). Mr. F. G. Cooke, architect, 2, Hyde Gardens, Eastbourne; Joseph Martin & Son, builders, Commercial Road, Eastbourne.

EAST HAM.—New school in Altmore Road.

EDINBURGH.—Alterations at Warrender Baths (£2,000).

FINCHLEY and NEW BARNET.—Six residences (from £643 to £1,500 each). Walter Bennett, Broadway, Finchley, architect.

FORT MATILDA (Clyde, N.B.).—Torpedo works for the Admiralty (£30,000).

GOSPORT.—New Liberal Club. G. and F. Lane, builders, Forton Road, Gosport.

HARDEN and HAWORTH.—New Police Stations (£1,374 and £1,680 respectively).

HALIFAX (Ovenden).—New Primitive Methodist Sunday Schools (£2,300). C. F. L. Horsfall & Son, architects, Lord Street Chambers, Halifax.

HARROW.—High-class dairy. W. Irwin, 303, Essex Road, N., builder.

HUDDERSFIELD (Golcar).—Block of houses and shop. P. Taylor & Co., architects, Milnsbridge.
(Dalton).—Detached residence. Douglas Hall, architects, Fartown, Huddersfield.

HORSHAM (Camelsdale).—New public schools (£1,925). Wm. Potter, builder, London Road, Horsham.

ILFORD.—Block of business premises opposite Ilford Station. Great Eastern Railway Co., owners.
Public library and hall (£5,843). H. Shaw, Town Hall, Ilford, engineer and surveyor. W. Westgate, Romford, builder.

KETTERING (Gretton).—New public schools and house (£3,750).

KILLAVULLEN (Co. Cork).—New national schools. D. J. Buckley, architect, 53, South Mall, Cork.

KILWINNING (N.B.).—New Town Hall in Byres Road. H. Thomson, Saltcoats, architect.

KINGSTON-ON-THAMES.—Model childrens' home.

LEEDS.—New Training College for Men and Women, for the Education Committee.
(Upper Wortley).—Extension of Bethel Congregational Church premises. Danby & Simpson, architects, 73, Albion Street, Leeds.
Re-building of dispensary. W. T. Lancashire, city engineer, Municipal Buildings, Leeds.

LLANIDLOES (Montgomeryshire).—Library and public offices, temperance hotel, and motor garage. Shayler & Ridge, architects, Bank Chambers, The Cross, Oswestry (Salop); Morgan Lloyd, builder, Rhayader.

LOWESTOFT.—Wesleyan Schools. T. H. Yelf, builder, 2, Riverside Road, Norwich.

LONDON (Cricklewood).—Shops. H. Neal, 101, Broadway, Cricklewood, builder.
Brondesbury (Netherwood Street).—Shops ("Brondesbury Market.") Geo. Wheeler, 133, Anson Road, Cricklewood.
(Westminster).—Married men's quarters at Regency Street for Police (£11,843). J. Dixon Butler, surveyor to Metropolitan Police, New Scotland Yard, S.W.

LONDON (SOUTH KENSINGTON).—Conversion of 32 and 33, Emperor's Gate into flats. H. Row, 1a, Kensington High Street, agent.

(KENSINGTON).—Flats in Church Street. John Douglas, 12, Exhibition Road, Prince's Gate, S.W., agent.

(BOROUGH, S.E.).—New premises for St. Mary's Club for Working Girls.

(STREATHAM).—New Coroner's Court (£6,000).

(CITY).—Re-wiring Guildhall (£500). F. Sumner, city engineer.

(BISHOPSGATE STREET, E.C.).—Premises for Chartered Bank of India, Threadneedle Street, E.C.

(REGENT STREET).—Rebuilding greater portion of the Polytechnic (£60,000).

(FOREST HILL).—Four blocks of flats. A. J. Dorrell, 25, London Road, S.E., builder.

(PUTNEY).—Motor garage. Simmonds Bros. & Sons, Ltd., 118, Cromwell Road, S.W., builders.

(W.).—Rebuilding 165, Oxford Street. Phillips, Phillips & Co., 6, Newman Street, Oxford Street, agents.

(KILBURN).—Shops in High Road. Amalgamated Estates, Ltd., Moorgate Station Chambers, E.C.

(N.W.).—Shops, &c., on site of 384, 386, 388, Euston Road. Phillips, Phillips & Co., 6, Newman Street, Oxford Street, W., agents.

(W.).—Extensive alterations to London, City and Midland Bank premises, corner of Edgware Road and Praed Street. Colls & Sons, 5, Coleman Street, E.C., builders.

LYTHAM (ANSDELL).—New Baptist church. Haywood & Harrison, architects, Lytham.

MANCHESTER.—New warehouse, Dale Street and Lever Street. Contractors: Robert Neill & Son, Manchester.

Congregational "Church House" to be built in Deansgate. Rev. J. Ross Murray, secretary of the Manchester Congregational Board.

New Congregational Church to be built in Clarendon Street, Moss Side. Rev. J. Ross Murray, secretary, Manchester Congregational Board.

(LEVENSHULME).—Church (£5,170). R. B. Preston, architect, Diocesan Chambers, Manchester; G. Macfarlane & Sons, builders, New York Street, Chorlton-on-Medlock, Manchester.

MANSFIELD.—Residence for R. H. Wiggins, Mansfield Park. Vallance and Westwick, architects, Mansfield.

MARKET HARBOROUGH (BRAYBROOKE).—Public school and house for Northants C.C. (£1,560).

MERTON.—Proposed new church (accommodate 500, cost £5,000). Rev. J. E. Jagger, vicar, Merton Vicarage.

MONEYREA (Co. DOWN).—Richard Little Memorial Schools. Hobart and Heron, architects, 120, Scottish Provident Buildings, Belfast.

MORPETH.—Hotel ("George and Dragon"). C. F. Murphy, architect, Lloyd's Bank Chambers, Morpeth.

NEWPORT (MON.).—County offices at Pentonville. Wm. Tanner, county surveyor, Newport (Mon.).

Premises at Orb, for the Orb Workmen's Club. W. H. Shute, architect, High Street, Newport.

OXFORD (HEADINGTON).—Public schools. W. H. Ashford, architect, 90, New Street, Birmingham.

OLDCASTLE (Co. MEATH).—Additions and alterations to the Northern Bank. H. C. Parkinson, architect, Armagh.

PINNER VIEW (MIDDLESEX).—Church of England (£600). Rev. Ramsay W. Couper.

PONTYPRIDD (PENRHIWCEIBER).—Institute for Messrs. Nixon's workmen. T. W. Miller, architect, Mountain Ash.

(PENRHIWCEIBER).—Primitive Methodist Church. Thomas Davies, builder, Penrhiwceiber.

PRESTON (POULTON-LE-FYLDE).—Wesleyan Sunday Schools and extension of chapel (£1,250). Potts, Son & Hennings, architects, 2, Birley Street, Blackpool; D. Walton & Co., builders, Thornton (Lancs.).

RADCLIFFE (LANCS).—New public offices projected.

RICHMOND-ON-THAMES.—New secondary school for girls to be built by the T.C.

ROCHDALE (FACIT).—Workmen's club premises. F. J. Hobson, architect, Rawtenstall and Bacup.

RUSHDEN.—Mixed schools to be erected by the C.C. (£5,000).

ST. LEONARDS-ON-SEA.—New wing to the Buchanan Hospital. G. Silverton, 46, Strand, E.C., architect.

SANDBACH (CHESHIRE).—Extensions to Bradwall Reformatory School. Architects: Alfred Price & Sons, Sandbach.

SHEFFIELD.—Soldiers' home. G. Malam Wilson, architect, Sheffield.

SKIBBEREEN.—Parochial Hall. W. H. Hill & Son, architects, 23, South Mall, Cork.

SLIGO.—Works for the Anglo-Continental Guano Works, London (£2,000).

SNAITH (YORKS.).—Schools at Drax. H. B. Thorp, architect, Goole.

SOUTHAMPTON.—Congregational Church extensions (£2,200). C. H. Brightiff, architect, Southampton; W. Franklin, builder, Southampton.

New fire station, &c., to be erected by the T.C. (£5,200).

SOUTHEND-ON-SEA.—Wesleyan Church. Mr. Gunter, architect.

SUNDERLAND.—Quarter sessions and police courts, fire brigade station, &c., to be erected by the T.C. (£11,500).

UPHOLLAND.—Extensions to the Grammar School.

WALLASEY.—Town hall to be erected by the U.D.C.

WEST HAM.—Alterations and additions to Canning Town School (£1,000). J. G. Morley, borough engineer.

WHITSTABLE.—Bank premises. Geo. Reeves, builders, Whitstable.

WELLS (SOMERSET).—Important extensions to the County Asylum (£14,100). Mr. Hine, architect.

WIGAN.—Important extensions to waterworks contemplated.

WIRKSWORTH (DERBYSHIRE).—Grammar School. G. H. Widdows, architect, St. Mary's Gate, Derby.

WOKING (SURREY).—London and South-Western Railway Servants' Orphanage (£19,129). W. E. Trevena, Southampton Street, South Farnborough, Hants, architect.

YARMOUTH.—Extension to the infectious diseases hospital for the T.C. (£1,050).

Strike.—About 250 men (general switchmakers and brass workers), employed at the Adelphi Works, Manchester, of the General Electric Co., Ltd., went out on strike on Monday. It appears that some months ago they asked for 2s. advance, and were granted 1s. The second shilling, the men contend, should have been paid about Whitsuntide.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—January 8th, 1908. One common battery switchboard and 3,000 subscribers' telephones (specification No. 166) for the Deputy Postmaster-General, Adelaide. Specifications can be seen at the Commonwealth Office, 72, Victoria, Street, S.W.

Austria.—August 31st. The Austrian State Railway authorities at Czernowitz are inviting tenders for the establishment of an electric plant at the railway station in that town for lighting and power purposes.

Beckenham.—July 22nd. Meters for the electricity department. See "Official Notices" July 5th.

Belgium.—July 27th. The municipal authorities of Ougrée, near Liège, are inviting tenders for the establishment of a central electric lighting station in the town. Particulars may be obtained for 25 francs from, and tenders are to be sent to, La Maison Communale, Ougrée.

Birmingham.—July 26th. Electrical pumping machinery (800 H.P.) for the Birmingham, Tame, and Rea District Drainage Board. See "Official Notices" July 12th.

Bristol.—Electric two-ton capstans (10) and movable electric jib cranes for the Docks. W. W. Squire, Engineer, Cumberland Basin, Bristol.

Calcutta.—January 2nd, 1908. According to the *Financial News*, tenders for any class of illuminant are invited by the Corporation for the lighting of the city.

Chorlton.—July 23rd. Wiring two hospital pavilions at the Withington Workhouse, West Didsbury, Manchester, for the Chorlton Union. Specifications from Messrs. Peers, Copland and Cardin, consulting engineers, 16, John Dalton Street, Manchester (deposit £2 2s.).

Dublin.—July 23rd. Machinery oils for the electricity works at Pigeon House Fort. See "Official Notices" to-day.

France.—July 27th. The Post and Telegraph authorities in Paris are inviting tenders for the supply of 360 tons of galvanised iron wire of varying diameter. Particulars may be obtained from, and tenders are to be sent to, Le Sous-Secretariat d'Etat des Postes et des Telegraphes, Rue de Grenelle, 103, Paris.

Germany.—The municipal authorities of Munich are about to invite tenders for the establishment of a sub-station in connection with the electric lighting undertaking, at an estimated cost of £46,500.

Perth (W.A.).—August 6th. Desiccating apparatus with motor-driven air-pump for telephone cable work for the Deputy Postmaster-General. Specifications at the Commonwealth Office, 72, Victoria Street, S.W.

Portsmouth.—August 5th. Welsh steam coal for the tramways power station. See "Official Notices" to-day.

Radcliffe.—July 20th. Low tension cable for the U.D.C. See "Official Notices" July 12th.

Rochester.—July 22nd. Permanent way and overhead line for Corporation tramways. See "Official Notices" July 12th.

Spain.—August 12th. The Spanish Ministry of Public Works in Madrid is inviting tenders until August 12th for the concession for the construction and working of an electric tramway in the town of Valencia.

Spain.—The municipal authorities of Alcira (province of Valencia) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

Stepney.—July 22nd. Testing switchboard, motor-generator and transformer, also distribution board and earthing panel for the electricity department. See "Official Notices" July 5th.

Sunderland.—August 22nd. Uniforms and caps for the tramways employés of the Corporation. See "Official Notices" to-day.

Sydney (N.S.W.).—August 14th. The Deputy Postmaster-General is inviting tenders for telegraph, telephone and electric light material.

Wednesbury.—July 23rd. Balancer boosters and accumulators for electricity works extensions. See "Official Notices" July 5th.

West Riding (Yorks.).—July 22nd. (1) Two engines and dynamos, electric light installation (including wiring, fittings, lamps, &c.); (2) Electric bells, telephones, fire alarms and recording clocks; (3) Heating and ventilation; for the second portion of the main institution of Storthes Hall Asylum. Tenders to J. Vickers-Edwards, architect, County Hall, Wakefield.

Willesden.—July 22nd. Stoneware conduits for the U.D.C. See "Official Notices" July 12th.

Wimbledon.—July 22nd. Edwards air pump equipment and voltmeters for the Corporation electricity department. See "Official Notices" July 12th.

CLOSED.

Bolton.—The Electricity Committee has accepted the tender of the British Westinghouse Co. for a centrifugal pump.

Croydon.—The T.C. has accepted the tender of Messrs. Harding, Churton & Co. for a motor and pump, at £178.

Gravesend.—The T.C. has accepted the tender of the Lancashire Dynamo and Motor Co., Ltd., for the supply of motors for hiring.

London.—Bermondsey.—The Electricity Committee has received the following tenders:—

7,000 Yards 4-in. Single-way Conduits and 100 Bends.

Sutton & Co. (accepted) (1) conduits, 1s. 0½d. per yard; (2) bends, 1s. 0½d. each, less 2½ per cent.
Albion Clay Co. (1) 1s. 0½d.; (2) 1s. 0½d.
T. Wragg & Sons (1) 1s. 0½d.; (2) 1s. 0½d., less 2½ per cent.
Doulton & Co. (1) 1s. 0½d.; (2) 1s. 0½d.
Johnson & Phillips, Ltd. (1) 1s. 3d.; (2) 2s. 9d.

Cable Boxes.

Johnson & Phillips, Ltd. (accepted) (1) six-way disconnecting joint boxes, £91; (2) five-way ditto, £91; (3) four-way ditto, £90; (4) three-way ditto, £54; (5) straight through ditto, £54 7s. 6d.; (6) end connecting ditto, £5 4s.
W. T. Glover & Co. (1) £97; (2) £98; (3) £93; (4) £60; (5) £58; (6) £6 16s.
Siemens Bros. & Co. (1) £97 10s.; (2) £103 5s.; (3) £99; (4) £57; (5) £58; (6) £6 4s.
Henley's Telegraph Works Co. (1) £162 10s.; (2) £138 5s.; (3) £96 15s.; (4) £95 10s.; (5) £58; (6) £6.
British Insulated & Helsby Cables, Ltd. (1) £221; (2) £225 15s.; (3) £126; (4) £75; (5) £79 15s.; (6) £8 8s.

7,400 Yards ·125 sq. in. and 400 Yards of ·2 sq. in. Low-Tension Triple-Concentric Lead-Covered Cable, and 120 Yards of ·2 sq. in. Low-Tension Triple-Concentric Lead-Covered and Steel-Armoured Cable.

Callender's Cable & Construction Co. (accepted for 1 and 2) (1) ·125 by ·125 by ·06, £2,980; (2) ·2 by ·2 by ·1, £226 5s.; (3) ·2 by ·2 by ·1 steel-armoured, £79 2s. 6d.
Johnson & Phillips, Ltd. (accepted for 3) (1) £2,981 17s. 4d.; (2) £229 16s. 5d.; (3) £75 4s. 5d.
British Insulated & Helsby Cables, Ltd. (1) £3,034; (2) £236; (3) £76 16s.
Henley's Telegraph Works Co. (1) £3,040; (2) £235; (3) £76 10s.
W. T. Glover & Co. (1) £3,041; (2) £235; (3) £76 18s.
Siemens Bros. & Co. (1) £3,078 10s.; (2) £237 18s.; (3) £77 5s.

Marylebone.—The B.C. has accepted the tender of Messrs. Parsons for the insertion of a steam temperature buffer on the turbines for £200. Messrs. Babcock also tendered for the work, at £192 10s., plus £25 for erection.

Stepney.—The B.C. has received the following tenders:—

Meters up to a Capacity of 10 Amperes.

Reason Manufacturing Co. (provisionally accepted)	£262
Chamberlain & Hookham, Ltd.	325
Ferranti, Ltd.	325

Meters above a Capacity of 10 Amperes.

Ferranti, Ltd.	£303
Chamberlain & Hookham, Ltd.	311

Ferranti, Ltd., quote on the basis of one year's free maintenance, as against three years in the case of Messrs. Chamberlain & Hookham, whose tender was provisionally accepted. Tenders from ten other firms for both classes of meters were declared informal.

Demand Indicators.

Engineering Instruments, Ltd. (informal)	£260
Monté-Callow & Co. (informal)	260
Reason Manufacturing Co. (provisionally accepted)	307

Annual Supply of Carbons.

Sloan Electrical Co. (provisionally accepted)	£767
Johnson & Phillips, Ltd.	799
Crompton & Co.	801
G. Branlik (5 per cent. for cash)	839
Union Electric Co.	894

Tenders have also been considered for the annual supply of coal.

L.C.C.—The Highways Committee of the L.C.C. have considered the following tenders for the supply of two of the four sets of 5,000-kw. three-phase steam turbo-generators for the second portion of the power station at Greenwich:—

	Turbo-generators, including provisional sum.	Spare parts.	Total.
Willans & Robinson (recommended)	£42,200	£1,875	£44,075
British Westinghouse Co.	42,443	1,366	43,809
" (alternative tender)	36,000	1,205	37,205
C. A. Parsons & Co	44,276	746	45,022
" (alternative tender)	39,866	655	40,521
Electric Construction Co.	44,790	491	45,281
British Thomson-Houston Co.	47,480	392	47,872
James Howden & Co.	48,000	489	48,489
General Electric Co.	48,636	463	49,099

The tender proposed for acceptance amounts to £42,200, and is therefore exclusive of spare parts, and the sub-letting of the generators to Dick, Kerr & Co. is to be permitted.

Long Eaton.—The U.D.C. has accepted the tender of Messrs. Browett, Lindley & Co., Ltd., for a steam dynamo and water-tube boiler, at £3,948.

Pontypridd.—The question of English *v.* German firms was the subject of a discussion at a meeting of the D.C. on Tuesday, when tenders for cables in connection with the electrical department were considered. It appears that on a contract of about £3,000 a German firm had offered to provide cables for about £500 less than the lowest quotation of an English firm. This latter had, however, upon learning that their tender was so much higher than that of the German firm, reduced the same to within £140 of its German competitor. A majority of three voted in favour of giving the contract to the German firm.

Prescot.—The Board of Guardians has accepted the tender of the British Insulated and Helsby Cables, Ltd., for cable, fittings, and wiring for the electric light at the workhouse. The company will also supply energy at 3d. per unit.

Rochdale.—The T.C. has accepted the tender of Messrs. Yates & Thom for the supply of additional plant for the electricity works.

Wimbledon.—The contract for 76 flame arc lamps has been awarded to Messrs. Foster & Co., after a prolonged test of the "Foster" lamp.

York.—The Corporation Electricity Committee has accepted the tender of the Adams Manufacturing Co. for the supply of "Igranic" motor starting rheostats for the period of 12 months dating from July 1st, 1907.

Melting Tantalum and Allied Metals by Means of Cathode Rays.

—Herr von Piram and Siemens & Halske, of Berlin, have taken out a United States patent for an apparatus in which tantalum and its allied metals can be melted so as to obtain a homogeneous product with the aid of cathode rays. The apparatus consists of a glass globe fitted with metal caps which are cemented on air-tight in position at the top and the base. The upper cap is made a cathode, and is connected to a concave plate for the emission of cathodic rays. The lower plate is the anode, and carries a small receptacle for the metals at the focus of the rays. The glass globe is evacuated sufficiently for the purpose in view, and the rays are deflected over the whole mass of metal in such fashion as may be necessary to ensure complete fusion, by means of an external magnet. It is stated that the electrical energy consumed is very efficiently utilised, and that the apparatus will work with alternating currents of such high pressures as 50,000 to 100,000 volts. The glass apparatus can also be employed in the shape of a bell cover standing on a flat plate, two electrical connections disposed convergently being fixed at the upper part of the glass. Each connection terminates in a concave disk fastened at such angles respectively as to have a common focus, and either disk can be made cathode. In this case the metal is supported in a dish carried from the bed-plate, where the air outlet is also fixed.

Rapid Measurement of Electrolytic Resistance.

—The specific resistance of an electrolyte varies in a marked degree with variations in concentration, temperature and purity, but in spite of this very little use seems to be made of the facts in technical operations. For example, an increase in the amount of various acids and salts in aqueous solutions, from 5 to 10 parts per hundred, produces a 50 per cent. change in the specific resistance, while the specific gravity changes only 3 per cent. Obviously then, the former measurement is the most sensitive, while the latter is the one actually adopted. The reason for this is probably due to a lack of some adequate, and at the same time simple, instrument capable of being used for rapid measurements. In a paper read before the American Electrochemical Society, Prof. Burgess describes an apparatus which has been used for several years in his laboratory, hardly any more trouble being required than when reading a thermometer. The resistance is measured in a glass tube containing suitable electrodes. Coupled in series with this is a voltmeter and a set of dry cells. The glass tube is mounted in an ebonite stand, through which the electrodes can be manipulated. The latter are kept short-circuited by means of a spring, but can be put in the main circuit by means of a slight pressure with the fingers. The operation is as follows:—The tube is dipped into the liquid to be measured, and the voltmeter read on the short circuit. The electrolyte is then put in series, and the voltmeter reading again taken. If R' is the resistance of the voltmeter, E the total voltage when short-circuited, and E' the second reading, then the specific resistance of the column of liquid in the tube is equal to R' multiplied by the ratio of E-E' to E'. This form of apparatus can be used for continuous work, and gives accurate readings.—*Electrochemical and Metallurgical Industry*, vol. V, No. 6.

DICK, KERR CRANE EQUIPMENTS.

The subject of electrical craneage, haulage and hoisting plant, which has frequently received attention in these pages, is more than ever to the front at the present time; and now that practical experience has enabled our electrical manufacturers to successfully meet the various little idiosyncracies peculiar to this class of equipment, one can hardly doubt but that the field for its employment will be extended beyond even its present extensive limits.

Among the firms who have devoted special attention to this class of work, none are better known than Messrs. Dick, Kerr & Co., whose wide experience in other motor-driven plant has been of direct advantage to them in this connection.

Through the courtesy of this firm we are able to illustrate several applications of their D.C. equipments to travelling and other cranes.

Thus our first and second illustrations, showing two travelling cranes in the erecting shop of one of the shipbuilding yards on the Clyde, demonstrate the feasibility of converting what were rope-driven cranes for electrical operation.

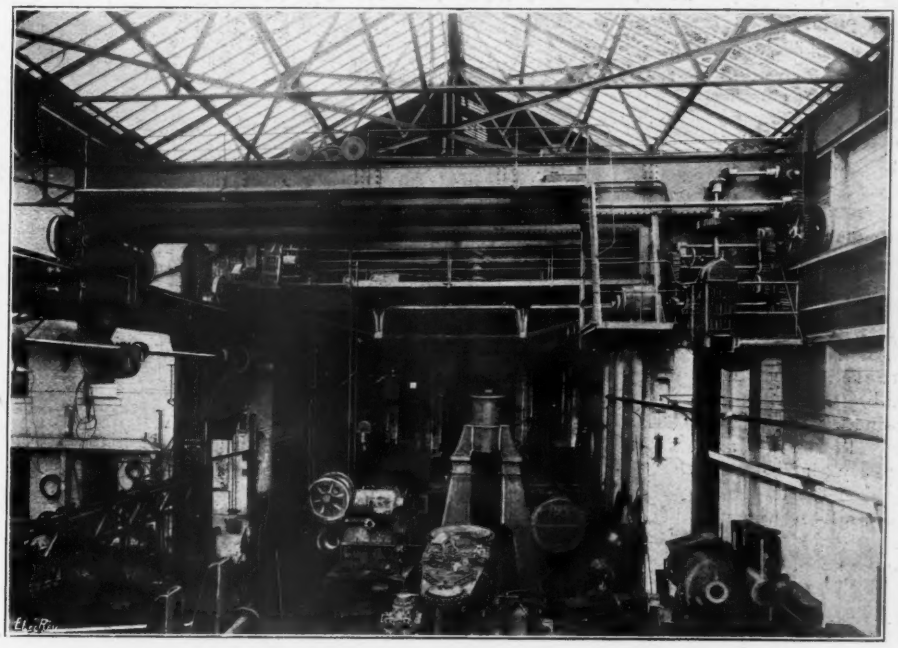


Fig. 1.—Electrically-driven Travelling Cranes, with Dick, Kerr Equipments.

The reconstruction was undertaken with a view to improving the working speeds, and each crane was fitted with a series motor and H-type controller and resistances.

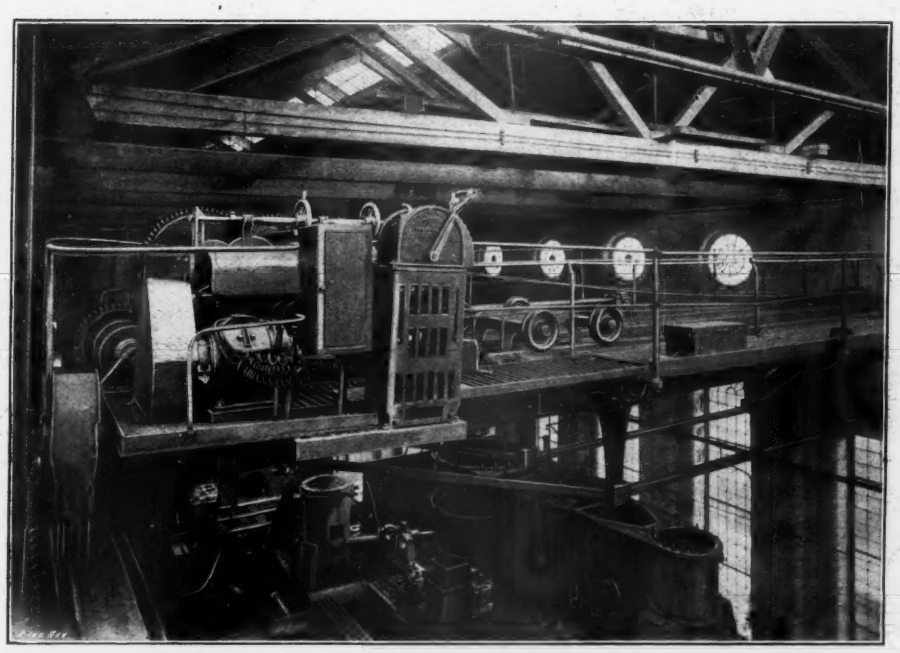


Fig. 2.—Showing the Motor and Controller Equipment, 7-Ton Travelling Crane.

The crane in the foreground, fig. 1, has a 15-ton lift, and the other one a 7-ton lift. The electrical equipment on the latter is clearly shown in fig. 2.

It is satisfactory to record that, as a result of the change the original working speeds have been doubled.

Figs. 3, 4 and 5 illustrate some equipments supplied by Messrs. Dick, Kerr for a steel works in Scotland.

In the foreground of fig. 3 is shown a 7½-ton high-speed travelling crane, fitted with three motors of 75, 50 and 30 H.P. respectively; this crane is used for carrying ingots, which have been removed from the retorts, through the smelting shop to the soaking pits, where they are reheated.

The ingots each weigh 3 tons, and they are usually carried in pairs as shown.

Fig. 4 shows the soaking pits and the special type of crane provided for handling the heated ingots. Each crane is fitted with six motors, one each of 35 H.P., 20 H.P. and 7½ H.P., and three of 5 H.P.

The two cranes shown, alternately carry out a cycle of operations necessary to feed the rolling mills with material.

The cover of the soaking pit is first removed by a claw; the ingot is then extracted by a grab, which immediately deposits its load in a cradle at the head of the trough shown, from which it passes by gravity to the mills.

Each cycle of operations takes some five minutes to complete; the rolling of the ingot to the required section in the mill occupies but a few minutes, and one crane follows the other in the delivery of ingots, to keep pace with the rolling operations.

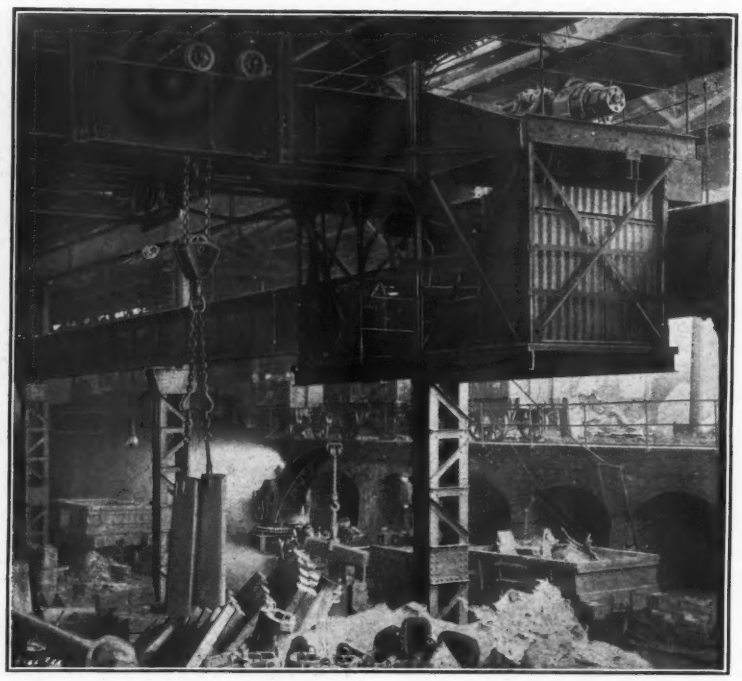


Fig. 3.—7½-Ton High Speed Traveller at a Scottish Steel Works.

trough along which the ingots travel by gravity to the live rolls, as mentioned previously.

The direction of rotation of the live rolls is reversed every few seconds as required by the feeding of the rolling mills.

As showing another application of the Dick, Kerr equipment, figs. 10 and 11 will be of interest. The former shows an electrically-operated wharf crane at Middlesbrough, similar in general outline to others which we have described there. The crane is operated by a 56-H.P. motor, which, with its gearing, is shown in the last figure.

The motors employed in this class of work are either series, shunt or compound wound, of the enclosed ventilated type, as shown in fig. 9. The bearings are lined with phosphor bronze and provided with ring oil lubrication.

The poles are of the laminated type, and are bolted to

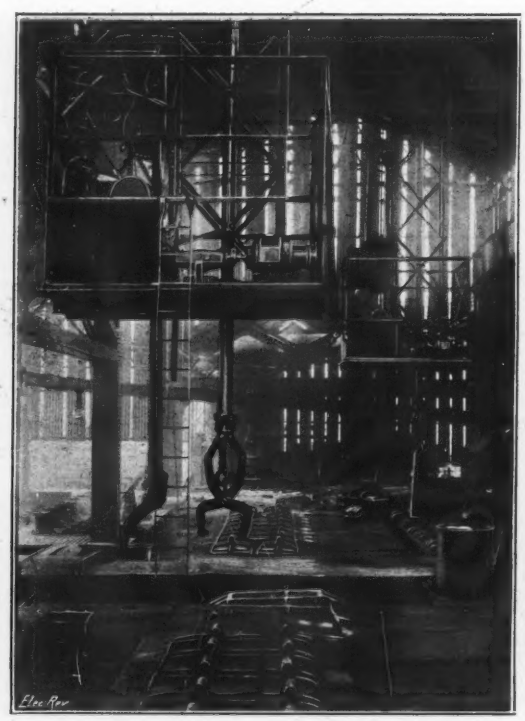


Fig. 4.—Special Crane for Dealing with Reheated Ingots

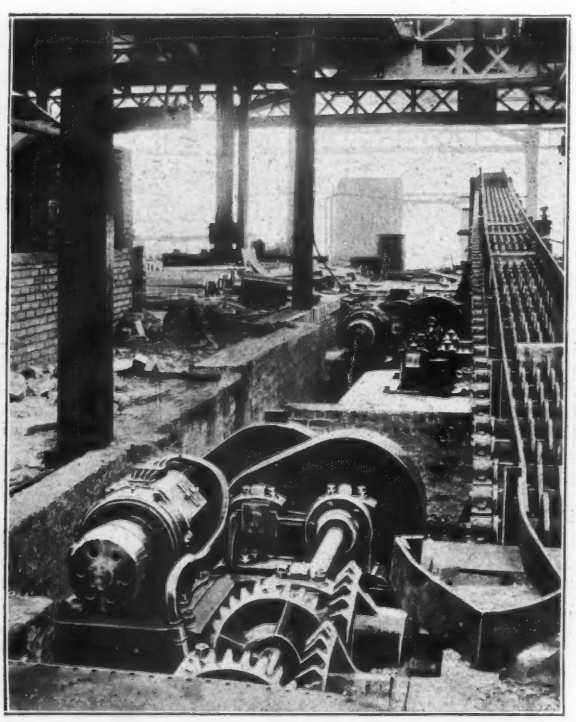


Fig. 5.—Electrical Gear for Driving Live Rolls.

Fig. 5 illustrates the electrical driving gears for the live rolls, which are operated by the two 50-H.P. totally-enclosed series-wound motors shown. On the right is shown the the motor shell. The armature is slot wound, and of a sufficiently substantial character to safely meet any emergency arising in heavy crane work. The core is built up of disks

which are keyed direct on to a hammered steel shaft, all the windings being impregnated with high insulation black varnish. Special attention has been given to the adequate ventilation of the motor, the steel shells being provided with air ducts, and the armature core having the usual ventilating grooves. Carbon brushes are employed, with fixed position for all loads.

One of the most interesting features of the Dick, Kerr crane motor is the magnetic brake, which can be attached if required. This brake (shown in figs. 6 and 9) is formed by an extension of the commutator-end bearing, an annular space being provided, in which is carried an exciting coil. On the extended hub is carried a conical cast-steel ring which is free to move laterally; in this ring steel springs are carried, which normally tend to push the ring away from the face of the magnet. At the extreme end of the motor shaft, a malleable iron crown is keyed. When the motor is disconnected from the power service, the spiral springs thrust the conical steel ring into the crown. When current is switched on the magnet becomes energised, and overcoming the thrust of the springs, attracts the ring to the face of the magnet, thus leaving the crown and consequently the shaft free to revolve.

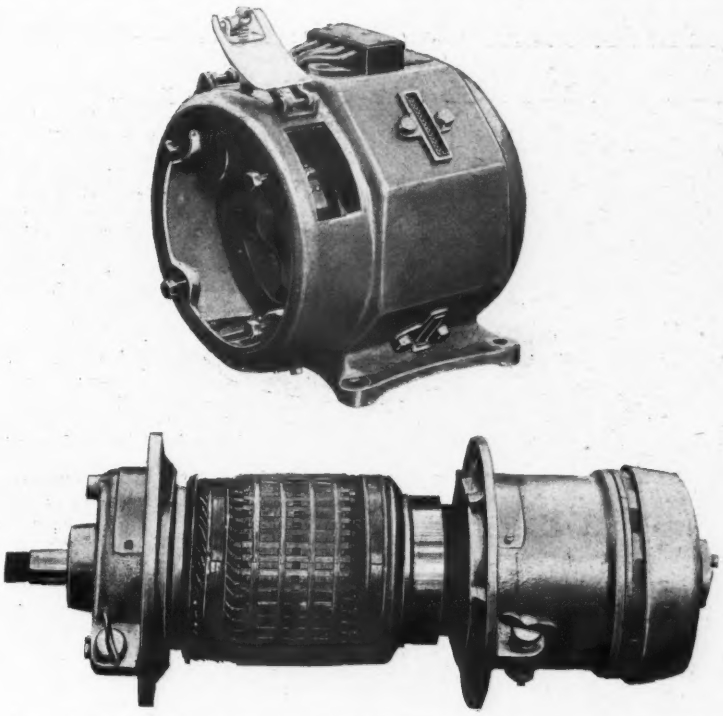
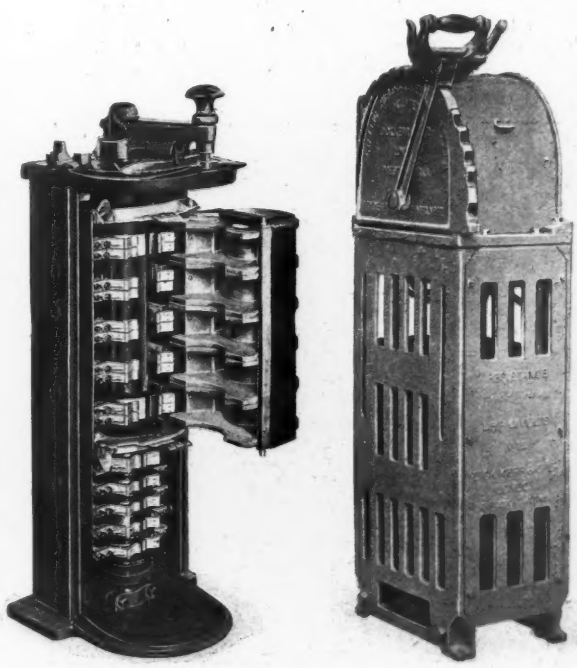


Fig. 6.—Dick, Kerr Crane Motor Dismantled, showing Carcase, Armature and Magnetic Brake.

A special controller has been designed as part of the firm's crane equipment, there being variations in form, as shown in figs. 7 and 8, according to the work for which it is intended. There is no doubt that the apparatus employed in the control of electric cranes and hoists is of supreme importance, for the success or otherwise of an electric system really hinges upon the efficiency of control. This apparatus is, however, frequently the most unsatisfactory, because its true functions are not always realised, and, in consequence, design and construction are poor and performance unsatisfactory. A crane controller must be so designed as to adequately meet all conditions of load during the period of operation. It must be both electrically and mechanically sound, as it is frequently handled by men who know nothing whatever of the apparatus, and therefore do not always realise when they are mishandling it.

A successful controller must operate the crane motions smoothly and without any jarring effect, and be practically fool proof. The success which has attended the Dick, Kerr controller is undoubtedly due in no small measure to the method of instantaneously breaking the arc formed on opening the circuit. As the operation of this controller is quite distinct from other methods, a short description may be of interest.



Figs. 7 and 8.—Showing the "R" and "H" Type Controllers Respectively.

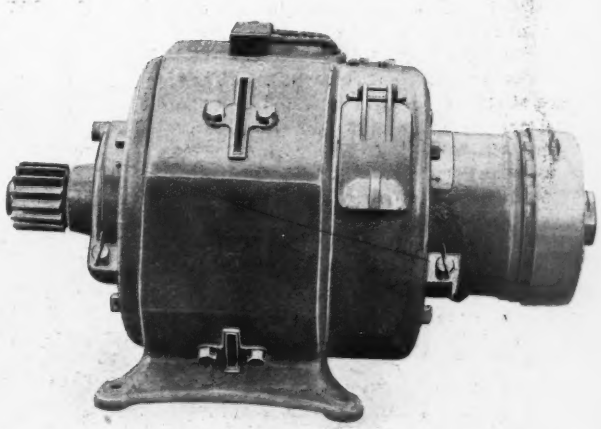


Fig. 9.—Standard Crane Motor, with Magnetic Brake.

It must be remembered that crane controllers are called upon to deal with heavy currents, and may be on occasion required to break a "short circuit" current. It necessarily follows that there would be excessive arcing, and unless this were immediately suppressed the controller would be liable to sustain serious injury. The form of the controller under review is a distinct advance on the ordinary magnetic blow-out type, for it not only contains most important modifications of the blow-out principle, but in other respects it shows

improvements, chiefly as regards simplicity of construction and ease of operation; it is known as the metallic shield blow-out type. The most conspicuous advantages offered in this controller are summed up in the statement that, unlike other magnetic blow-out systems, the effectiveness of the metallic shield increases in direct proportion to the current: the older type of magnetic blow-out which is still employed by some makers for crane operation, works satisfactorily up to the point of saturation of the magnet, consequently with a heavy over load, which is frequently obtained in practice, there is no corresponding increase in the blow-out effect. The metallic shield blow-out effect increases in direct proportion to the current, consequently the more powerful the arc the greater is its effectiveness. The operation of the magnetic blow-out depends upon driving the arc in a direction parallel to the axis of the controller cylinder. In the metallic shield blow-out the arc is lifted directly away from the cylinder in a direction at right angles to its axis. The insulating partitions, therefore, are never in the direct line of the arc, and it is impossible for one arc to reach another, adjacent, because the solenoid effect is produced between each one individually.

Fig. 10.—Wharf Crane, Middlesbrough, with Dick, Kerr Equipment.

Of the two forms of controller illustrated, fig. 7, represents the R type, in which the contact cylinder is vertical and the resistances are separate. The maximum capacity of this type is 1,000 amperes at 650 volts.

In the H type, shown in fig. 8, the contact cylinder is mounted horizontally over the resistances and the reversing part of the controller. The maximum capacity of this type is 300 amperes at 650 volts.

In both types of controller the connections provide for obtaining two running notches from each resistance section.

The blow-out coil is never short-circuited, being shunted in all positions except in going "off," when the maximum effect of the metallic shield is available.

The resistances for currents larger than 15 amperes are made of cast-iron grids insulated with mica.

A Non-Stop Run.—Details of a non-stop run by a 150-kw. three-phase belt-driven alternator are given by Mr. Rhodes, assistant manager of the United States Smelting Co., West Jordan, Utah. The generator was put in service on October 15th for 11 hours per day, until November 9th, 1902, when a service of 24 hours per day was required. On January 25th, 1904, a paper pulley went to pieces, and a cast-iron one was substituted in 15 minutes. From June 15th to 18th, 1904, the switchboard was moved, and all feeder circuits were connected directly on the machine, without switches or fuses, by means of jumpers, and no mishap occurred sufficient to cause a shut down. Last year a screw worked out of one of the split oil rings on the pulley end. Not being able to shut down, the run was continued with the remaining one until March 28th, 1907. At this point, the machine was stopped and repaired, and commenced again. The alternator is belt-driven, and an engine is located on either side with belt attached, in case of emergency. Bearing in mind that the machine carries a continuous overload of 25 to 60 per cent., its record is truly wonderful.—*Electrochemical and Metallurgical Industry*, Vol. V, No. 6, 1907.

A Modern Electrically-Operated Copper Converter.—One of the most interesting of converter plants is now being erected by the Oxford Copper Co., at Constable Hook, N.J., under the supervision of the chief engineer. This consists of three electrically-operated stands and nine shells, 84 in. diameter and 126 in. long. For turning the shell, each stand is provided with a 30-h.p. Allis-Chalmers direct-current, variable speed, multipolar, enclosed type series-wound motor for 110 volts and 600 r.p.m., which is geared up to the main driving shaft, so that the maximum speed of shell is reduced to 1½ r.p.m. To regulate the turning speed of the converter shells, there is a suitable controller, arranged with a liberal number of speeds in each direction. The motor shaft is connected to the worm shaft by a coupling, which also acts as a brake wheel for the solenoid brake, and in this extension is keyed a single-thread steel Hindley worm that runs in an oil bath and meshes with a solid worm wheel, thus making the first reduction. On the worm-wheel shaft is secured a cast-steel pinion, which in turn transmits its energy to a steel gear, both having shrouded teeth and designed for taking care of severe shocks. The gear is keyed to a hollow steel shaft, which has fitted to the driving end a universal coupling, arranged so that the shells will lie true on the rollers and at the same time the drive will adjust itself to suit the alignment, and thus avoid any undue strain on the driving shaft. On the head of the shell is a groove, which matches a tongue on the universal drive. When placing the shell in position on the stand, the motor is turned round until the tongue is vertical, leaving clearance enough on each side for keys. These latter are tapped into place and hold the whole construction rigid. The complete frame for supporting the motor and carrying the gears consists of a massive box frame casting with all bearings liberally proportioned and lined with the very best babbitt. The capacity of each converter is about 780,000 lb. of copper per month.—*Electrochemical and Metallurgical Industry*, Vol. V, No. 6, 1907.

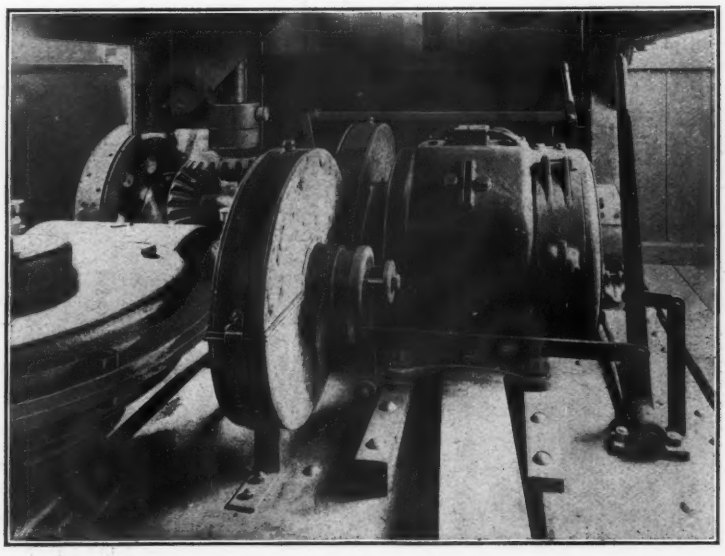


Fig. 11.—Showing 56-h.p. Motor and Gearing for Middlesbrough Wharf Crane.

NOTES.

The B.A. Meeting at Leicester.—The British Association for the Advancement of Science holds its meeting at Leicester from July 31st to August 7th. The following is the programme for the Engineering Section:—

Thursday, August 1st.—Presidential Address by Prof. S. P. Thompson, F.R.S.

Dugald Clerk—"The Present Condition of Gas and Petrol Engines."

Friday, August 2nd.—Joint meeting with the members of the Chemical Section (B) to discuss "Gaseous Explosions with Special Reference to Temperature."

Monday, August 5th (Bank Holiday).—Sir W. H. Preece, K.C.B., F.R.S.—"Pupin's Compensated Cable for Telephone Transmission."

J. T. Morris—"Note on an Oscillograph Study of Duddell Arcs of Low Frequency."

L. Gaster—"Developments in Electric Incandescent Lamps."

H. I. Brackenbury—"Modern Machinery and its Future Developments."

J. F. Brooks—"A Machine for Weighing the Forces on a Cutting Tool."

R. S. Ball—"Note on the Governing of Hydraulic Turbines."

Tuesday, August 6th.—J. S. E. de Vesian—"Ferro-Concrete and Examples of Construction."

W. Noble Twelvetrees—"Some New Uses for Reinforced Concrete."

H. T. Barnes—"The Ice Problem in Engineering Work in Canada."

E. G. Coker—"The Equipment of the Engineering Laboratory of the Finsbury Technical Institute."

On the afternoon of Friday, August 2nd, members of the section are invited by Mr. C. Bennion to a demonstration of boot and shoe-making machinery at the works of the Union Co.

On Saturday, August 3rd, an expedition is arranged for members of the Section, over the Leicester and Swannington Railway, one of the earliest railways laid down in England.

Imperial College of Science and Technology.—The first meeting of the governing body of the Imperial College of Science and Technology was held last week at the Victoria and Albert Museum, South Kensington. The Right Hon. R. McKenna, M.P., President of the Board of Education, who was accompanied by Sir Robert Morant, opened the meeting. The following were among the members of the governing body present:—The Earl of Crewe, Sir F. Mowatt, Sir Julius C. Wernher, Sir W. H. White, Principal MacAlister, Dr. Glazebrook, Prof. Capper, Sir A. W. Rücker, Sir J. Wolfe Barry, Viscount Esher, Sir A. Geikie, Prof. Dalby, Sir Alexander Kennedy, Mr. T. Hurry Riches, Mr. R. K. Gray, Sir Hugh Bell, with Mr. F. E. Douglas as secretary (*pro. tem.*). Mr. McKenna, in opening the meeting, took the opportunity to explain the arrangements which would have to be made for the transfer of the Royal College of Science and Royal School of Mines to the control of the governing body, and referred to the importance of the work which lay before the governing body in connection with the provision and organisation of advanced technical education within the empire. On the motion of Viscount Esher, seconded by Sir Alexander Kennedy, Lord Crewe was unanimously elected chairman. On Lord Crewe taking the chair, Mr. McKenna handed to him the letters patent containing the grant of the charter of the Imperial College. Provisional Committees (including a Finance Committee of which Sir F. Mowatt was appointed chairman) were appointed to deal with preliminary matters and to report to the next meeting of the governing body, which was fixed for to-day, 19th inst.

Electric Shock Fatality.—An inquest was held on July 8th into the death of Thomas Farrell, aged 16 years, which was caused by an 11,000-volt electric shock received while at work at the Newport, Middlesbrough, works of Messrs. Samuelson. According to the evidence, the lad had been employed by the Electrical Co. of London for some time, but had no previous knowledge of electricity. R. J. Baker, electrical fitter, who was employed by the company and engaged at the works on the same job, said that at the sub-station the two middle panels were "dead" and the other two "alive," the current having been passing through the latter during the whole of the week. The pressure of the current was 11,000 volts. Farrell had often worked in the place before. Deceased told witness that he had orders to vaseline the connections on the "dead" switches. Witness said he went into the station with him, and showed him which were "dead" switches and which were "alive." He also warned him to be careful, and told him if he could not reach anything from the floor he was not to climb up. He then went out, and left the deceased to do the work, and after finishing it he came and asked for some turpentine. Shortly after, witness heard a loud report, and on running into the station he found the lad lying on the floor, opposite one of the "live" panels, which deceased had evidently been painting. His right hand had been burnt, and deceased said, "Pick me up; I have had a shock." Witness thought the boy had intended to paint one of the dead panels, and had made a mistake and commenced to paint one of the "live" ones. He did not think deceased had been ordered to paint the switch. Carl Peterson, engineer in charge of the work, said the station was well protected, and had levers which showed which panels were "dead" and which were "alive." T. W. Kennedy, electrician, who supervised the work, stated that he never instructed Farrell to do any painting. Dr. Walter Benson deposed that the lad was dead when he arrived. Both his hands were burnt, and, in his opinion, death was due to electric shock. The coroner, at the close of the evidence, remarked that it seemed that the young fellow, out of excess of zeal, had commenced the painting which was not needed. The verdict was "Death through receiving an electric shock," no one being to blame for the occurrence.

German Iron and Steel Industries.—A Berlin correspondent of the *Times* (July 15th) concludes an article on this subject as follows:—"But the most important reason for expecting a heavy expansion of German steel exports remains to be mentioned. The steel mills of the country are now rapidly undergoing a complete revolution in the development and application of power. Furnace and coke-oven gases have nowhere else come into such general use for developing power as in Germany. The gas engine and the steam turbine are rapidly displacing the old reciprocating steam engine in German steel mills; and electricity for driving the rolls will soon be universal. German technical experts expect a great and permanent reduction of the costs of production through these radical changes, and, indeed, practice has already demonstrated the correctness of their views. Other countries, of course, have also begun the same revolutionary process, but Germany is far in advance of them all, and will undoubtedly make its enhanced competing power felt in neutral markets long before it has been overtaken by them. It may safely be concluded that Germany's competition in outside markets will be felt more keenly during the next ten years than ever before."

Institution and Lecture Notes.—SOCIETY OF ARTS' CONVERSAZIONE.—The conversazione of the Society of Arts was held on Tuesday, July 9th, in the gardens of the Royal Botanic Society. This function, which is usually looked upon as one of the most enjoyable of the season, was entirely spoilt by the weather. Although the gardens were very prettily illuminated, visitors immediately on arrival made for the refreshment rooms, which at once became crowded; and those who were later in arriving had to take refuge in the conservatories, where they were entertained by the bands of the Royal Marine Light Infantry and H.M. Coldstream Guards. Those ladies who had obviously come to be seen in their latest "creations," no doubt suffered for their temerity, as probably did also Miss Elizabeth Holt, the heroine in the Watteau play "La Marquise," performed in the open air, who very bravely went through the business of dying on the wet grass under the rays of the limelight. In the Club House, concerts were performed under the direction of Mr. Patrick Kirwan, which were highly appreciated by packed houses, and also by those who, crowding up to the windows to escape the rain, were able to catch a note or two now and again.

Appointments Vacant.—Shift engineer for Elland electricity works; technical assistant to take charge of the Sunderland Corporation electricity department test room (£156); Assistant Superintendant of Telegraphs for Ceylon (£300).

A New Recruit.—According to the *Daily Mail* of the 13th inst., Mr. John Burns, presiding at a conference on the proposed federation of six towns in the Potteries, stated that "Federation would result in cheaper electricity, and, as an old electrical engineer, Mr. Burns said: 'I am green with envy of the opportunity for exploiting the district.'"

It is not quite clear that Mr. Burns actually called himself "an old electrical engineer," but the context certainly supports the idea, and it would be interesting to learn—

1. When Mr. Burns was in the electrical profession.
2. When he was an engineer.

Our impression was that the now President of the Local Government Board was at one time—the time when he was "engineering" strikes—a fitter. To call a fitter an "electrical engineer," even though he be employed in an electrical company's works, is a ridiculous libel (on one or the other). We believe Mr. Burns was promoted direct from the bench to the floor of the House of Commons, and thence to the Board over which he now presides—and we never before heard of him as a (reformed) electrical engineer.

Electrochemical Notes.—ELECTROLYTIC PRECIPITATION OF CYANIDE SOLUTIONS.—According to an article recently published by Mr. C. P. Richmond, a modification of the ordinary Siemens & Halske process for precipitating cyanide solutions has been successfully introduced at the San Sebastian mines, near Santa Rosa in Salvador. The ores worked there are very complex, containing much copper; and when treated by the ordinary cyanide process, although 95 per cent. of the gold is recovered, so much copper is thrown down with it that it is impossible to part the metals. In fact, the cathodes finally consist of 3·73 per cent. of gold, 65 per cent. of copper, and the rest lead, for which material the refining works pay very badly. The modified process devised by Richmond, on the other hand, gives a gold varying between 750° and 850° of fineness, yields a copper in the metallic state, and leaves the lead electrodes uninjured. The solution containing the gold is brought into an electrolysing vessel, 30 × 10 × 4 ft. in. size, divided into 12 compartments, 10 of which contain 25 anodes and 24 cathodes each. The anodes are composed of thin sheet lead oxidised with permanganate, the cathodes are thick plates of lead. The current density is 1 ampere per sq. ft. and the voltage is from 4 to 5. During the electrolysis from 80 to 90 per cent. of the metal is reduced, and the liquid then flows into two zinc troughs in which another 9·5 per cent. is recovered. The lead cathodes

remain in the electrolytic vat for 20 to 30 days, until they weigh from 8 to 12 lb. They are then taken out, introduced into 2 per cent. sulphuric acid, and used as anodes with a current of 5 amperes per sq. ft. In these conditions the copper dissolves and is deposited as a powder upon lead cathodes, afterwards falling to the bottom of the cell, while the gold is precipitated as an anode sludge, and is collected in bags. At the end of the process the lead anodes are put back into the cyanide vessels and made cathodes once more.

Porous Diaphragms of Wood.—Messrs. Q. Marino and E. W. Barton-Wright have taken out a French patent for a process which is stated to convert wood into a porous diaphragm fit for employment in electrolytic cells, and one which confers upon the material a high resistance to the corroding action of electrolytes. The process consists in treating wood for eight to ten hours with cuprammonium oxide, then removing the copper by treatment with 0·88 ammonia for five or six hours, next washing the wood and soaking it in crude nitric acid for from two to four hours (which converts the gummy material into a yellow resin) and finally exposing it to a blast of steam and sulphur dioxide for 5 to 15 minutes. The last operation results in the formation of a mixture of nitric and sulphuric acid, which converts the cellulose into nitrocellulose and allows the latter to be dissolved out of the material with the aid of alcoholic caustic potash and ethyl acetate. The product is stated to possess a considerable amount of malleability.

Electrolytic Production of Iron in Norway.—Some experiments carried out recently by A. Hiorth in the new electro-chemical institute of the Technical High School at Christiania have shown that a good quality of metal can be obtained by electrically smelting a low grade of iron ore unfit for reduction in the blast furnace together with impure Norwegian graphite. The original iron-sand contains about 13 per cent. of titanic acid and 20 per cent. of silica, whereas the finished metal contains not a trace of titanium and only 0·01 per cent. of silica. The graphite employed occurs in many parts of Norway in beds 30 to 60 ft. thick.

The Calcium Cyanamide Industry.—According to a recent report published in the *Chemiker Zeitung*, the problem of utilising atmospheric nitrogen may be regarded as practically solved, and the day is not far distant when this source of nitrogen will be the only one employed in the manufacture of artificial fertilisers. Already cyanamide is being made from nitrogen in almost all civilised countries. The Società Generale della Cianamide, of Rome, owns the process for obtaining calcium cyanamide from atmospheric nitrogen, and has acquired all the patents taken out by Frank and the Cyanid Gesellschaft, of Berlin. More latterly, however, the last mentioned company has made some improvements in the process, rendering the use of expensive furnaces and retorts no longer necessary. In Germany a limited company entitled the Chemische Werke Nonnendamm, G.m.b.H. has been formed with a capital of 300,000 M. in which both the Società Generale della Cianamide, and the Cyanidgesellschaft, are financially interested. The Brandenburgische Carbidwerk G.m.b.H. has also obtained a licence for Germany and Norway, and is able to make about 2,500 tons per annum at its factory in Mühltahl (Bromberg), handing 5 per cent. of the net profit to the Roman company. In London, the North-Western Cyanamide Co., Ltd., has been promoted with a capital of £120,000, also stated to be financially connected with the Roman company. A works is being built at Odde in Norway, near the Alby United Carbide Factories, where some 12,500 tons of calcium cyanamide are to be made from 10,000 tons of calcium carbide, the latter being procured from the Alby Factories. In Italy the Società Prodotti Azotati is the owner of the patent. The works of this company at Piano d'Orte are now being enlarged to a capacity of 10,000 tons per annum. This enterprise is connected with the Soc. Generale, and has made an arrangement with the Soc. Italiana del Carburo di Calcio, for the supply of the necessary carbide. The Soc. Italiana Prodotti Azotati has obtained a licence for Austria-Hungary, and is about to erect a second works, while the factory of the Società per l'Utilizzazione delle forze Idrauliche della Dalmazia, which is already in existence there, has an annual capacity of about 10,000 tons. In France the Société Française des Produits azotés, having its office in Paris and a capital of 100,000 fr., has an exclusive licence. It also is connected with the Società Generale della Cianamide. The works of the French company are at Notre Dame de Briançon, in Savoy, and are capable of producing 3,750 tons per year, but their capacity is likely to be increased shortly. In Switzerland the Société Suisse des Produits azotés has its headquarters in Geneva, and its factory in Martigny; the capacity of the factory is also 3,750 tons.

Dry Filling Material for Electric Accumulators.—Herr C. Bergmann, of Berlin, has taken out a German patent for an improved form of material for insertion in electric accumulators to replace the usual gelatinous mixture of sodium silicate and sulphuric acid. Instead of making this mixture with the aid of sulphuric acid of 30° Baumé, the inventor uses acid between 40° and 60° B., and so obtains a hard porous mass rather like pumice in consistency, which allows the gases developed during the charging of the accumulator to escape without doing any damage. A suitable mixture is prepared by taking one part of 33 per cent. sodium silicate and two parts of sulphuric acid having a specific gravity of 1·53. When the mass is made, as much of the surplus acid as is requisite can be removed by extraction with water.

Electrical Accidents during 1906.—In the annual report of the Chief Inspector of Factories and Workshops for 1906, there is published the report of the electrical inspector (Mr. G. Scott Ram) on electrical accidents. We shall publish an abstract of the more interesting parts of the report in our next issue.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. J. F. C. Snell, on the termination of his services as borough electrical and tramway engineer at Sunderland on July 10th. was presented by the Corporation with a solid silver tea and coffee set and tray, in Georgian design, and weighing 307 oz. In an address, the Corporation pays Mr. Snell a high tribute, and, among other things, says: "The Council deem Mr. Snell to be a gentleman of personal worth and great engineering ability, eminently reliable as an adviser in his profession." The presentation was made by Alderman Bruce.

On July 5th, Mr. Ernest Francis, upon his retirement from the post of secretary to the Reading Electric Supply Co., was presented by the directors with a silver rose bowl.

The Salford Electricity Committee has appointed Mr. Herbert J. Hawkins, of Enfield, Middlesex, deputy electrical engineer for the borough, at a salary of £250 per annum.

The Ilford U.D.C. has been recommended to increase the salary of Mr. J. E. Allen, mains superintendent, from £190 to a maximum of £200 per annum.

We find that an item given in this column on July 5th is not strictly correct. Mr. T. H. Birrell was offered the appointment as engineer to the Pontypool Electric Light Co., but after consideration decided not to accept it.

Tramway Officials.—The Ashton-under-Lyne T.C. has increased the salary of Mr. J. W. Dugdale, tramways manager, from £200 to £260 per annum.

The Lord Chancellor has added the name of Councillor R. R. Fairbairn, manager of the local tramway and omnibus systems, to the Commission of the Peace for the City of Worcester.

General.—The financial journals say that Mr. Ralph D. Mershon, of New York, is on his way to the Cape by the *Armadale Castle*. He is about to proceed to Johannesburg, where he will join Mr. H. Wilson Fox, the manager of the British South Africa Co.; Mr. Arthur Wright, the consulting engineer of the Marylebone Electrical Works; and Mr. Bertram Fox, of Sir Douglas Fox and Partners, who are all there on business connected with the large installation now being constructed for the Victoria Falls Power Co., which will be erected within the next two years.

In consequence of the retirement of Mr. H. Buxton Forman, C.B., the Postmaster-General has appointed Mr. A. H. Norway to be an Assistant Secretary to the Post Office.

Mr. H. W. Goodfellow, electrical engineer to Messrs. Wm. Cory & Son, Ltd., on leaving Erith for the firm's new works at Rochester, has been presented by the staff and employés with a marble timepiece.

Mr. F. T. Murdoch, proprietor of the Mansourah Electric Supply Co., Egypt, is now in England for the summer, and his address is Nile House, Westbury Gardens, Ealing, W.

Mr. H. Wilson Young informs us that he has resigned his office as a director of Messrs. Bergtheil & Young, Ltd., and has severed his connection with that firm and all other concerns in which they are interested.

On Saturday last, in connection with the celebration of the 25th anniversary of the foundation of University College, now the University of Liverpool, honorary degrees were conferred on several distinguished personages. Among them were Principal Sir Oliver Lodge (Birmingham); Sir A. B. W. Kennedy; Sir W. Ramsay; Sir H. E. Roscoe and Mr. E. K. Muspratt. Among the recipients of the degree of Master of Engineering were Mr. J. A. Brodie, City engineer; Mr. A. B. Holmes, consulting electrical engineer, Liverpool, and Prof. W. H. Watkinson.

Obituary.—We regret to announce that Mr. A. J. H. Carter, late borough electrical engineer to Stockport Corporation, died on Saturday, July 6th, at Brighton. Mr. Carter started as apprentice at the Brighton Railway locomotive works, was afterwards assistant to Prof. Jago, and he then spent six years abroad in various positions. Upon his return to England he was connected with the Brighton Corporation electricity works, until 1897, when he proceeded to Stockport. There, after starting up the undertaking, he remained until last year, when his health broke down.

Gaston Emmanuel Sautter.—We learn with regret of the death, in his 53rd year, of Monsieur G. E. Sautter (Sautter, Harlé and Co.), of Paris. M. Sautter, who was a civil engineer, was a Chevalier de la Légion d'Honneur, and a member of the Chamber of Commerce of Paris. His death occurred on June 21st.

We have to place on record the death, which occurred on July 9th, in London, of Herbert Tibbits, M.D., whom many of our readers will doubtless remember as the nominal plaintiff in the case of Tibbits *v.* Alabaster and Others, which was the first of a series of libel actions commenced in the year 1893, consequent upon the Electrical Review's exposure of the Medical Battery Co. and the Harness electropathic belts. Dr. Tibbits was 67 years of age at the time of his decease.

Sir W. H. Perkin, F.R.S.—We deeply lament having to record the death of Sir William Henry Perkin, F.R.S., of coal-tar industry fame, which occurred on 14th inst., at Sudbury, from double pneumonia. He was born in March, 1838. It will be remembered

that it was only last year that anything approaching due recognition was paid to the life work of Perkin, on the occasion of the international celebration of the fiftieth anniversary of his great discovery. His Majesty conferred the honour of knighthood upon him last year, and since then other honours had fallen thick and fast in this and other countries.

NEW COMPANIES REGISTERED.

Western Electric Co. (Australia), Ltd. (94,135).—This company was registered on July 11th, with a capital of £2,000 in £1 shares, to carry on in Australia or elsewhere the business of dealers in telephones, telephonic, telegraphic and electric lighting apparatus, instruments and machinery, electric cables and wires, &c. The first subscribers (each with one share) are:—F. R. Wells, 171, Queen Victoria Street, E.C., manufacturer; J. E. Kingsbury, 171, Queen Victoria Street, E.C., manager; A. T. Turney, 171, Queen Victoria Street, E.C., engineer; A. Williamson, Western Electric Co., North Woolwich, electrical engineer; W. E. Leigh, Western Electric Co., North Woolwich, accountant; H. M. Pease, Western Electric Co., North Woolwich, electrical engineer; and F. Loveridge, Yewhurst, Belvedere, Kent, manufacturer. No initial public issue. Table "A" mainly applies. Registered office, 171, Queen Victoria Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brecknell, Munro and Rogers, Ltd. (79,766).—This company's annual return was filed on June 11th, when 958 preference and 14,829 ordinary shares had been taken up out of a nominal capital of £30,000 in 2,000 preference shares of £5 each and 20,000 ordinary shares of £1 each. £1 per share has been called up on 767 ordinary and £5 per share on 958 preference shares, and £5,557 has been received. 14,062 ordinary shares are considered as fully paid. Mortgages and charges: Nil.

Thomson-Davies Telephone System, Ltd. (64,901).—This company's annual return made up to January 28th, was filed on May 31st. 5,695 shares have been taken up out of a nominal capital of £6,000 in £1 shares. £1 per share has been called up on 842 and 12s. 6d. per share on 360 shares, and £997 has been received, leaving £90 in arrears. £4,493 is considered as paid on 4,493 shares. Mortgages and charges: Nil.

Peterborough Electric Traction Co., Ltd. (74,562).—This company's annual return was filed on May 2nd, when 4,400 preference and 4,000 ordinary shares had been taken up out of a nominal capital of £60,000 in £5 shares (6,000 preference). £5 per share has been called up, and £42,000 has been received. Mortgages and charges: £21,000.

D. Santoni & Co. (1906), Ltd. (electrical engineers, London), (89,277).—Issue on June 22nd of £440 debentures, and on July 5th of £330 6 per cent. debentures, part of series created May 31st, 1907, to secure £2,750, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £1,650.

J. H. Street, Ltd. (electrical engineers, Redditch), (91,826).—Issue on February 7th of £400 7 per cent. debentures, part of series created same date to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Registered June 24th, pursuant to Order of Court.

Oliver Arc Lamp, Ltd. (Woolwich), (90,880).—Particulars of £15,000 debentures, created by resolution of May 30th, 1907, have been filed pursuant to Section 14 (4) of the Companies' Act, 1900. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Supplies, Ltd. (electricians, Liverpool), (82,737).—Issue on June 17th of £200 5 per cent. debentures, part of series created April 17th, 1907, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £800.

Newcastle-upon-Tyne Electric Supply Co., Ltd. (27,997).—Issue on June 20th of £2,200 4½ per cent. second mortgage debentures, part of series created February 15th, 1906, to secure £250,000 charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £185,300.

W. Lucy & Co., Ltd. (51,908).—This company's annual return was filed on June 18th, when 250 preference and 1,030 ordinary shares had been taken up out of a nominal capital of £15,000 in 250 preference and 1,250 ordinary shares of £10 each; £10 per share has been called up on 250 preference and 781 ordinary, and £10,310 has been received; £2,490 is considered as paid on 249 ordinary. Mortgages and charges: £7,000.

British Insulated & Helsby Cables, Ltd. (52,285).—This company's annual return, made up to April 1st, was filed on May 16th. The entire capital of £1,000,000 in 100,000 preference and 100,000 ordinary shares of £5 each, has been taken up; £5 per share has been called up on 74,470 preference and 40,065 ordinary shares, and £572,675 has been received; £427,325 is considered as paid on 25,530 preference and 59,935 ordinary. Mortgages and charges: £500,000.

London United Tramways, Ltd. (71,844).—This company's annual return, made up to March 18th, was filed on May 22nd, when 125,000 preference and 105,000 ordinary shares had been taken up out of a nominal capital of £2,500,000 in 125,000 preference and 125,000 ordinary shares of £10 each; £10 per share has been called up on 89,000 preference, £8 per share on 39,993 ordinary and £10 per share on seven ordinary shares, and £1,210,014 has been received; £960,000 is considered as paid on 36,000 preference and 60,000 ordinary shares. Mortgages and charges: £1,331,000.

An agreement dated May 10th, 1907, relating to the conditional issue of debentures for an indefinite amount, has been registered. Property to be charged: The company's undertaking and assets, including uncalled capital (except certain property at Brentford), subject to first debentures. Holders: Parr's Bank, Ltd., and Speyer Brothers, 7, Lothbury, E.C.

Burgess Hill and District Electric Supply Co., Ltd. (85,698).—A memorandum of satisfaction in full of a charge dated November 29th, 1906, securing an unspecified amount, but stamped to cover £700, has been filed.

A debenture dated June 17th, 1907, to secure £1,200, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holder: Mrs. E. L. Burrows, View Down, Burgess Hill, Sussex.

Uxbridge and District Electric Supply Co., Ltd. (62,706).—Issue on July 1st of £1,000 6 per cent. second debentures, part of series created July 10th, 1906, to secure £15,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £14,000.

Electrical Power Storage Co., Ltd. (30,313).—Issue on July 1st of £1,600 5 per cent. debentures, part of series created February 14th, 1907, to secure £30,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £8,400.

Limia Co., Ltd. (87,734).—A memorandum of satisfaction in full of debentures, dated November 26th, 1906, securing £2,000, has been filed. A prior lien debenture, dated June 21st, 1907, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital, has also been registered. Holders: Equitable Debenture and Assets Corporation, Ltd., 721, Salisbury House, E.C.

Mevagissey Electric Supply Co., Ltd. (91,968).—£1,300 5 per cent. debentures, created and dated June 24th, 1907, charged on the company's undertaking and property, present and future, including uncalled capital, except the amount uncalled on any ordinary shares issued as part of the consideration for the purchase of the undertaking and assets of the Mevagissey Electric Lighting Co., Ltd., and except the amount to be subscribed or for the time being uncalled in respect of the first 300 preference shares to be issued, have been registered. No trustees.

Frank Suter & Co., Ltd. (electrical engineers, London), (57,193).—£1,000 5 per cent. debentures, created and dated June 26th, 1907, charged on the company's undertaking and property, present and future, including uncalled capital, have been registered. No trustees.

Lancashire Dynamo and Motor Co., Ltd. (61,447).—This company's annual return was filed on May 4th, when 850 ordinary and 470 preference shares had been taken up out of a nominal capital of £150,000 in 1,000 ordinary and 500 preference shares of £100 each. £100 per share has been called up and £132,000 has been received. Mortgages and charges: Nil.

A trust deed dated June 24th, 1907 (supplemental to a trust deed dated March 4th, 1907, securing £75,000 debentures and increasing the interest from 4½ per cent. to 5 per cent.) has been registered. Property charged by original deed: Certain land in Trafford Park, Stretford, near Manchester, with all works, erections and buildings thereon and fixed plant and machinery therein, and the company's undertaking and other assets, present and future, except uncalled capital. Trustees: E. F. Sheppard, 55, King Street, Manchester; and A. Tongue, 86, King Street, Manchester.

White, Jacoby & Co., Ltd. (52,494) (electrical engineers London).—Re-issue on June 26th of £1,080 and on June 28th of £100 5½ per cent. debentures, and on June 29th of £300, part of series created May 31st, 1897, to secure £1,500, charged on the company's property, present and future, including uncalled capital. No trustees. Previously issued of same series: £1,500.

Perth Electric Tramways, Ltd. (55,935).—This company's annual return was filed on May 23rd, when the entire capital of £200,000 in 100,000 ordinary and 100,000 preference shares of £1 each had been taken up and paid for in full. Mortgages and charges: £229,287.

Woodhouse and Baillie Riviera Co., Ltd. (62,791).—This company's annual return was filed on May 13th, when 14,700 first preference, 4,000 second preference, and 4,000 ordinary shares had been taken up out of a nominal capital of £50,000 in 16,000 first preference, 20,000 second preference, and 14,000 ordinary shares of £1 each. £1 per share has been called up on 14,700 first preference, resulting in the receipt of £14,660. £40 remains in arrears. £8,000 is considered as paid on 4,000 second preference and 4,000 ordinary. Mortgages and charges: nil.

Oriental Telephone and Electric Co., Ltd. (40,691).—This company's annual return was filed on May 9th, when 179,318 ordinary and 50,000 preference shares had been taken up out of a nominal capital of £300,000 in 200,000 ordinary and 100,000 preference shares of £1 each. £1 per share has been called up on 7,816 ordinary and 50,000 preference, resulting in the receipt of £57,828 10s., including £12 10s. paid on 50 ordinary shares forfeited. 171,497 shares are considered as fully-paid. Mortgages and charges: £100,000.

Barnsley and District Electric Traction Co., Ltd. (72,962).—This company's annual return was filed on May 31st, when £4,007 ordinary and 4,000 preference shares had been taken out of a nominal capital of £50,000 in 5,000 ordinary and 5,000 preference shares of £5 each, £40,035 has been paid. Mortgages and charges: £20,000.

Helis Cell and Accumulator Co., Ltd. (London) (88,437).—A debenture dated June 24th, 1907, to secure £650, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holder: R. A. Draper, 11, Calfe Road, Forest Hill.

Controls, Ltd. (London) (90,700).—£750 debentures, created 12th and dated June 27th, 1907 charged on the company's property, present and future, including uncalled capital, have been registered. No trustees.

Brockie-Pell Arc Lamp Co., Ltd. (London) (66,602).—Issue on June 25th of £6,000 6 per cent. debentures, part of series created May 30th, 1907, to secure £8,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. No previous issue of same series.

St. Austell and District Electric Lighting and Power Co., Ltd. (66,382).—Particulars of £2,000 second debentures, created June 21st, 1907, charged on the company's undertaking and property, present and future, including uncalled capital, subject to £2,000 first debentures, have been filed pursuant to Section 14 (4) of the Companies' Act, 1900. No trustees.

Marconi International Marine Communication Co., Ltd. (65,759).—Issue on July 5th of £5,000 7 per cent. debentures, part of series created November 20th, 1905, to secure £25,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £20,000.

Bryant Trading Syndicate, Ltd. (electric lamp manufacturers, &c., London) (67,051).—£5,000 8 per cent. debentures, created June 21st, 1907, charged on the company's undertaking and property, present and future, including uncalled capital, but excluding any property abroad, have been registered. No trustees.

Northwood Electric Light and Power Co., Ltd. (66,312).—This company's annual return was filed on July 4th, when 12,357 ordinary and 2,260 preference shares had been taken up out of a nominal capital of £30,000 in 15,000 ordinary and 15,000 preference shares of £1 each. £1 per share has been called up on 8,132 ordinary and 2,260 preference, resulting in the receipt of £10,392. £4,225 is considered as paid on 4,225 ordinary. Mortgages and charges: Nil.

Lancashire Light Railways Co., Ltd. (57,018).—A mortgage or charge dated June 29th, 1907, to secure an indefinite amount, but stamped to cover £6,000, has been registered. Property charged: All moneys due or to become due under a working agreement with the St. Helens and District Tramways Co.; all moneys, shares, securities or other consideration to which the company may become entitled as the purchase money in respect of any sale of its railway property or undertaking or part thereof; the company's railway and any extension thereof, with all tolls, rates and charges for the time being authorised to be demanded or charged in respect thereof; and the company's undertaking and property, present and future, including uncalled capital (subject, as regards railway, &c., to any working agreement). Holder: J. Beecham, Ewanville, Huyton, Lancs.

Ferranti, Ltd. (electrical engineers, Hollinwood).—A trust deed dated June 13th, 1907, to secure £20,000 prior lien debentures, has been registered. Property charged: Certain leasehold property at Failsworth, Manchester, and the company's undertaking and property, present and future, including uncalled capital. Trustees: J. M. Henderson, 2, Moorgate Street Buildings, E.C.; and A. W. Tait, Basildon House, E.C.

ELECTRICITY SUPPLY ACCOUNTS.

Manchester Municipal Electricity Supply.

Were it not for the importance of Manchester's electricity supply, one would be tempted, after glancing at the meagre details contained in the annual report, to pass it over with bare reference. The doings of a public undertaking which is in the unique position of generating some 63 million units last year at a cost of ·15d. per unit, and which claims upwards of 20,000 H.P. of motors connected, are surely worth more than the few words allotted in this year's report. That the undertaking still progresses is clear from a comparison of the 1906 and 1907 returns, and the fact that power supply in the city is making such good progress augurs well for continued prosperity.

The total energy sold amounted to 47½ million units, the combined cost of production (three stations—coal, oil, wages, repairs, &c.), amounted to ·2d. per unit sold. The gross revenue averaged but 1·75d. per unit, which, as the total working costs amounted to ¾d. per unit, left 1d. to meet other charges.

General Statement.

For year ending March 31st ...	1907.	1906.
Total capital expended	£2,338,373	£2,267,127
Number of units sold—		
Private supply	22,686,508	18,255,313
Public lighting	91,938	94,613
Traction	24,786,457	22,267,858
Total number of units sold ...	47,564,903	40,617,784
Equiv. No. of 8-C.P. lamps connected (private lighting)	628,133	565,208
H.P. of motors connected (exclusive of traction)	17,462	12,110
Number of public lamps	41	53
Maximum load in KW.	25,180	21,923
Revenue account—		
Gross revenue	£346,545	£329,199
„ expenditure	£144,801	£141,117
„ profit	£201,744	£188,082
Average inclusive price obtained per unit—		
Private supply	2·24d.	2·60d.
Public lighting	2·12d.	1·25d.
Traction	1·26d.	1·38d.

Revenue Account for Year ending March 31st, 1907.

Gross revenue...	£346,545	= 1·75d. per unit.
Works and distribution costs	106,969	= ·54d. „
Total working costs	144,801	= ·73d. „

Profit Statement for Year ending March 31st, 1907.

Interest on loans, &c.	£65,955
Sinking fund and loan instalment	69,519
Renewals account	40,000
Net surplus	26,267
Gross profit	£201,744

From the net surplus a sum of £2,352 has been appropriated for extension of works, for which borrowing powers could not be obtained, and the balance, £23,915, has been carried to the reserve fund.

The latter has been depleted owing to vibration and explosion costs, and some £47,122 has practically been invested in warehouse property, so that the balance in hand only amounts to £6,323.

The renewals account now amounts to £100,612, some £13,978 having been debited and £40,000 credited during the year.

Mr. S. L. Pearce is the chief engineer.

ELECTRIC TRAMWAY ACCOUNTS.

Manchester Corporation Tramways.

Year by year the Manchester tramway system continues to expand both in mileage and financially. This year's report shows that inclusive of running powers (some 6 miles) the total length of route operated amounts to 96 miles, or 9 in excess of the previous year; some 10 million more passengers were carried, and with improved averages in the working, the financial result makes a satisfactory comparison with previous years. The general manager is Mr. J. M. McElroy.

General Statement.

For 12 months ending March 31st...	1907.	1906.
Length of route	96 miles.	87 miles.
Total length of track	169½ „	151½ „
Car-miles run	15,523,459	14,655,908
Passengers carried per annum... ...	143,264,501	133,923,932
Capital expended to date	£1,725,845	£1,675,812
Traffic receipts	£712,976	£661,806
Total receipts	£719,673	£663,707
Working expenses	£454,693	£433,561
Gross profit	£264,980	£230,146
Income per car-mile	11·12d.	10·87d.
Working expenses per car-mile ...	7·03d.	7·10d.
Interest and sinking fund per car-mile	1·38d.	1·44d.
Rental of leased lines	·37d.	·29d.
Total expenses per car-mile	8·87d.	8·83d.
Profit per car-mile	2·34d.	2·04d.
Cost of energy per car-mile	2·03d.	2·09d.
Average fare per passenger	1·19d.	1·19d.
Revenue per mile of route	£7,496	£7,628
Expenditure per mile of route ...	£4,740	£4,984
Total units used	25,072,791	22,164,445
Units used per car-mile	1·61	1·53
Percentage of working ex'es to receipts	63%	65%

The receipts were approximately ¼d. per c.m. better than in 1906, while working expenses were lower than in that year, the decrease being almost accounted for in the lower power cost. The latter item still exceeds 2d. per c.m., both the amount used (1·61 units per c.m.) and cost (at 1¼d. per unit) being somewhat heavy.

Details of the working expenditure per car-mile are as follows:—

	1907.	1906.
Traffic expenses	3·04d.	3·10d.
General expenses	·98d.	1·00d.
General repairs and maintenance—		
Permanent way ... ... ·143d.	·17d.	
Electrical equipment of line ·11d.	·10d.	
Buildings and fixtures ... ·037d.	·034d.	
Machinery and plant ... ·01d.	·011d.	
Cars ... ... ·66d.	·577d.	
Other rolling stock ... ... ·02d.	·018d.	
	·98d.	·91d.
Power expenses	2·03d.	2·09d.
Total working expenses ...	7·03d.	7·10d.

The gross profit was some £35,000 in excess of last year's figure; its disposal, as in previous years, benefited both the reserve and the ratepayer.

Since January, through-running powers have been exercised between the centre of the city and both Oldham and Ashton-under-Lyne; the actual extension to the Corporation's track during the year amounted to 10 miles.

The parcels department has evidently received a thorough overhaul during the year, as during the first 6 months it operated at a loss of £6,245, and during the latter half of the year, when its scope was curtailed, it made a profit of £266, the difference, £5,979, being debited to reserve.

Inclusive of accumulated interest the profit balance dealt with amounted to £266,891, which was allocated as follows:—

Interest	£50,141
Sinking fund	39,594
Rental, &c., of tramways	24,039
Leaseholds, income-tax, &c. ...	6,078
Surplus	147,039
	£266,891

The surplus, which is some £27,000 better than last year, was disposed of as to £87,827 to reserve, renewals and depreciation, £55,000 to the rates, and £4,212 to street improvements, &c.

The reserve and depreciation account now stands at some £320,000.

CITY NOTES.

Buenos Ayres Grand National Tramways Co., Ltd.

The directors' report for the year ending March 31st, 1907, states that the gross receipts of the lines operated by the Buenos Ayres Grand National Tramways Co., Ltd. (consisting of the lines of this company and those of the Buenos Ayres New Tramways Co., Ltd.), have amounted to £321,256, as compared with £252 597 for the previous year. The working expenses amounted to £220,389, as compared with £192,893. The net receipts amounted to £100,867, as compared with £59,704. The Grand National Co.'s share of the above net receipts under the agreement has amounted to £68,406, as compared with £45,557 for the previous year. After payment of London administration expenses, interest on debentures, &c., there remained £27,230, from which £900 has been transferred to debenture reserve funds and £3,726 to income bondholders' interest account, and there has been paid on February 15th, 1907, £9,000, being the interim dividend of 2 per cent. on the 5 per cent. cumulative preference shares, leaving £13,604, which the directors recommend should be appropriated as to £13,500 to the payment of a further 3 per cent. on the preference shares (making 5 per cent. for the year to March 31st, 1907), and as to £104 to the credit of the contingency fund, which will then stand at £6,956. Since the last ordinary meeting further progress has been made with the work of converting for electric operation the joint system of this company and of the Buenos Ayres New Tramways Co., Ltd., and at June 30th, 1907, there had been converted a total length of 75¾ miles.

Crompton & Co., Ltd.

The directors' report to March 31st last, states that during the financial year the works at Chelmsford have been fully occupied, and it has been found necessary to make still further extensions to the shops, in order to deal with the increasing business in a prompt and economical manner. It is with pleasure that the directors are able to state that the improved results at the works referred to in last year's report have been more than maintained, and that, notwithstanding the increased cost of raw material, the selling and contracting departments of the company have succeeded in earning satisfactory profits. The net profit for the year amounts to £38,291, as compared with £20,060 in the preceding year, and from this figure has been deducted the sum of £6,572, representing the loss on stock which, owing to the introduction of improved designs, it has been thought advisable to sell or scrap. After providing for debenture interest, directors' fees, and other items shown in the net revenue account, there remains, with the sum brought forward from last year, an available balance of £30,165. The directors propose to declare a dividend at the rate of 5 per cent. per annum for the year, to provide £1,500 for doubtful debts and contingencies, to place £10,712 to the reserve fund, bringing that account up to £20,000, and to carry the balance £5,840, forward. Although the accounts of the Electric Supply Corporation for the last financial year are not yet published, the directors have reason to believe that the undertakings of the Corporation are making steady progress. A sum of £8,950 has been invested during the year in shares of the Guaranteeing Co., referred to in the report for the year ending March 31st, 1905, being the estimated amount required for the year's dividend on the shares of the Electric Supply Corporation. The amounts so invested are repayable out of future profits of the Electric Supply Corporation. The directors are of opinion that the amount proposed to be placed to reserve out of the year's profits is sufficient to provide for any possible depreciation of the investments. In view of the activity of the company's business, and particularly of the importance of some of the contracts in hand, the directors deem it advisable to ask the shareholders to increase their borrowing powers from the present limit of £150.000 (in which is included the debenture issue of £100,000) to £200,000, and for this purpose a resolution will be submitted to the meeting. The orders and contracts already secured are of such volume that satisfactory results for the current year may be anticipated.

[Last year the ordinary dividend was 2½ per cent., and £5,817 was carried forward.]

Shanghai Electric Construction Co., Ltd.

The report for the 18 months ended May 31st, states that satisfactory progress has been made with the construction, and the permanent way is nearly complete. The overhead work, and the work of laying the cables, are in a similarly advanced state. Several of the cars have already been shipped, and it is expected that the remainder will reach Shanghai by Oc ober. So far as the company is concerned, it appears probable that the whole of the undertaking will be ready by October 10th, the date fixed by the tramway concession. It will, however, be impracticable to provide a through service over the whole of the system by that date, as the reconstruction of the Garden Bridge and Chekiang Road Bridge, which is being carried out by the Shanghai Municipal Council, will not be finished. The track lies almost equally on the north and south sides of the Soochow Creek, which is crossed by the bridges above referred to, and, if the Council sanctions the opening of the tramways before the bridges are completed, each portion can be separately operated for a time by carrying feeder cables across the Soochow Creek on temporary supports. The Council will not be ready to supply power until November. The board has decided to purchase additional land adjoining the site provided for the carshed by the contractors, and also to improve the tramway system by doubling the track in certain of the more important thoroughfares, with a view to accelerating the service, and correspondingly benefiting the gross receipts. This additional expenditure was not provided for by the issue of shares which was made in December, 1905, and it is the intention of the directors to borrow about £30,000 to pay for the additions mentioned. It is proposed that steps should at once be taken for splitting each of the existing shares of £1,000 each into 100 shares of £10 each; and it has been thought desirable, in the interests of shareholders, to provide for the issue of share warrants to bearer to those who desire to have them in exchange for their present certificates. It is believed that this will be a great convenience to shareholders resident in Shanghai.

South Wales Electrical Power Co.

The directors' report for the year ended December 31st, 1906, as reprinted in the *South Wales Daily News* reads thus:—

"Your directors regret that the annual meeting could not be held earlier, owing to the protracted negotiations caused by the financial position of the company. That position was fully explained to the shareholders at the extraordinary meeting held on July 2nd, 1906, when the shareholders approved the Bill for enabling the company to raise £500,000 of prior lien debenture stock, which Bill received the Royal assent on August 4th, 1906. The undertaking has, since June 1st, 1906, been carried on by an arrangement with the consumers, under which they have paid prices for current supplied, which have enabled the works to be kept going without loss. Every effort has been made to raise the further capital required to enable the company to complete the part of the undertaking then in hand, and to supply power to various collieries with which agreements had been made, and to others with which negotiations were in progress. Certain financial firms largely interested in the company were prepared, under the advice of the most experienced experts, to find the £500,000 thought necessary to put the undertaking on a sound footing, if 40,000 H.P. could be guaranteed under contracts for 15 years. After long negotiations with the consumers this was found to be impossible, and since then other schemes have been put forward in the interests of the shareholders, who will be asked to approve certain proposals at the extraordinary meeting to be held at the close of the ordinary meeting. The retiring directors —Mr. Walter Stowe Bright McLaren, Mr. Thomas Hugh Weguelin, and Mr. William Walker Hood—do not seek re-election, and the other directors, viz., Lieut.-General Sir Richard Heiram Sankey, K.C.B., R.E., Mr. Hugh Watts, and Mr. Henry Ruffer, have sent in their resignations. The chairman will resign at the meeting. It will be necessary for the shareholders to appoint new directors, and the names of the following gentlemen who are willing to act will be submitted to the shareholders for their approval:—Messrs. W. F. Brown, St. Mary Street, Cardiff, mining engineer; J. W. Hutchinson, Trehafod, colliery agent; W. Cope, Bridgend, barrister-at-law; W. G. Dalziel, Clytha Park, Newport, colliery proprietor; R. Thomas, Melingriffith, tinplate manufacturer; T. Griffiths, Cymmer, colliery agent; W. L. Madgen, London; G. T. Hutchinson, London; and T. O. Callender, Kent."

National Telephone Co., Ltd.

The directors' report for the half-year ended June 30th, shows that the income accrued in respect of the business amounted to £1,314,791, as compared with £1,195,152 for the corresponding period of 1906, being an increase of £119,639. The working expenses amounted to £753,208, as compared with £691,738 for the corresponding period of 1906, being an increase of £61,470. The net result for the half-year (after deducting the Post Office royalties amounting to £125,312) is a profit balance of £436,271, as compared with £390,066 for the corresponding period of 1906, being an increase of £46,206. The rentals carried forward for unexpired terms of running contracts amount to £1,210,117, as compared with £1,106,639 at the corresponding period of 1906, being an increase of £103,478. Out of the available balance of £331,979 shown by the net revenue account, the board will recommend the payment for the half-year of a dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per cent. per annum on the preferred stock, and 6 per cent. per annum on the deferred stock and new shares, less income-tax in all cases. The board also propose to transfer £130,000 to the reserve fund, and to carry forward the balance of £9,662. The sum of £583,758 has been expended on capital account during the half-year in the erection of £20,967 additional exchange and private stations, and in the construction of underground works. The lamented death of the general manager, Mr. W. E. L. Gaine, on June 18th last, has deprived the company of an officer whose conspicuous ability and devoted service have been of the highest value. The duties of general manager will in future be discharged by a managing director, and at the unanimous request of his colleagues, Mr. George Franklin has consented to accept that position in addition to his office of president. The board have elected Lord Balfour of Burleigh as a director to fill the vacancy caused by the death of Sir James Fergusson, Bart.

Electrical Power Storage Co., Ltd.

Mr. J. T. Courtenay presided over the meeting held on Thursday last week at 4, Gt. Winchester Street. In moving the adoption of the report he congratulated the shareholders on the results of the year's working. After payment of debenture interest, the profit for the year was £8,751, which, with the sum of £425 carried forward,

made a total of £9,176. Out of that sum the directors had placed £1,000 to the credit of the contingent fund, which now amounted to £10,000. That sum they considered was ample for any requirements which might fall on that special fund, and as at present advised they did not intend to further increase it. In addition, £2,000 had been written off the amount standing in the balance-sheet under the heading of patents, goodwill account. They recommended a similar dividend to that of the last four years, namely, 6 per cent. That would absorb £5,390, leaving £787 to be carried forward. During the year £3,597 had been spent on renewal, repair and maintenance of buildings, plant and tools, and £2,381 on the purchase of new plant. That latter figure included £600 as the first instalment on new suction gas plant to provide power for the works, and they were hoping that a reduction in the cost of manufacture would be made when they got the benefit of the full installation of that cheap form of power, instead of relying, as they did at present, partly on steam and partly on electric power supplied by the Borough Council. The original debentures of the company (£30,000), of which only £28,400 were issued, matured and were paid off on the 30th ult. £10,000 (part of an authorised new issue of £30,000) had been issued, which the directors considered would be sufficient for the present. When he addressed the shareholders last year he intimated that there were signs that the extreme depression in this particular branch of the electrical industry was passing away. That forecast, he was pleased to say, had been fulfilled, and during the past year they had not only had a record in the amount of turnover, but also the actual weight of batteries turned out from their works had exceeded that in any previous year of the company's existence. Unfortunately, however, the enormous rise which had taken place in the price of raw materials had told very heavily against them, and the increasing keenness of competition had prevented their raising prices to the extent which would have been fully justified owing to this rise in raw materials, so that notwithstanding the the increased turnover they were only able to show a profit slightly in excess of that of last year. Those who were intimately connected with that branch, or indeed any branch, of the electrical industry, would regard that as a very gratifying result, considering the peculiar circumstances at present generally existing in the trade. To show them the abnormal increase which had taken place in prices, he mentioned that during the past year they had paid for pig lead on an average 22 per cent. more per ton than in the financial year ending May, 1906. The increase in the output had been spread over all the various types of batteries manufactured by the company, including those for central stations, house lighting, telegraphs, telephones, electrically-propelled vehicles, and small types. They would continue to push the sales of the batteries in all directions, and by strict economy in the cost of manufacture, and at the same time maintaining a high standard of excellence, they hoped to counteract to some extent the disturbing influences already alluded to. There was not anything novel to report this year in the direction of "revolutionary" storage batteries. They were always on the watch for new inventions, but inventors were sometimes rather shy in submitting their discoveries to stringent tests.

Mr. Frederick Green seconded the motion, and the report was adopted.

Consolidated Electrical Co., Ltd.

The directors' report for the year ending March 31st, 1907, says that the ordinary income amounted to £7,532, in comparison with £3,851 for the previous year. Of the balance of £10,727 standing to the credit of revenue account the interim dividend of 3 per cent. paid on the preference shares, January 1st, 1907, absorbed £450, leaving a disposable balance of £10,277. The final dividend of 3 per cent. paid on the preference shares on the 1st inst., absorbed £450, and the directors now recommend the payment of a dividend of 3½ per cent. for the year (comparing with 3 per cent. for the previous year) on the ordinary shares. This will absorb £3,850 and leave a balance of £5,977 to be carried forward. The position of the Anglo-Portuguese Telephone Co., Ltd., is entirely satisfactory. Considerable improvement has been effected in the position of the Private Wire and Telephone Installation Co., Ltd. The unsecured liabilities of the Consolidated Supply Co., Ltd., to this company have been reduced during the year by the issue to this company of a further amount of 5 per cent. debentures, and the item of "investments" has been increased correspondingly.

The annual meeting was held on Monday at River Plate House, Mr. Herbert Allen presiding. In moving the adoption of report, he said that the year under review had not been a very eventful one, and after the immense improvement they had effected in the position of the company in the two previous years, it was perhaps only natural that they should go a little more slowly. He hoped it was only a case of marking time until they made a further step forward in progress. The first feature in the accounts was the largely increased income of the company. That, of course, was primarily due to the important batch of assets they had succeeded in getting together in place of the old manufacturing business which was so long a burden to the company. Their income was £7,532 as compared with £3,851 in the previous year, and this was a very handsome increase. They might have gone further and claimed that their income was £8,982, but they had no desire to bring in what were merely nominal profits, such as the £1,000 balance received in connection with the sale of the Canonbury works. It was simply a book-keeping transaction, and the board did not want the shareholders to mistake it for substantial profit. Owing to the motor-car industry they had been able to dispose of the Coventry property at a profit of £500 on what it had been written down to in the books, and here again the board had been careful to differentiate between exceptional profit and one earned in the regular course of business. Apart from these items, their ordinary income for the year from investments and the temporary utilisation of the little floating capital they had, they had earned the respectable sum of £7,532. They had once more succeeded in substantially reducing the administrative expenses, which were £1,604—a reduction of £307. Those charges in the last year of the old company—1902-3—were £5,443. In the first year of the new company they reduced them to £2,600, last year to £1,911, and now to £1,604, and in the current year he believed they would get them down to under £1,500. On the other hand, in the last year of the old company there was an admitted loss of £3,780, although, as a matter of fact, it a was great deal higher. In the first year of the new company they got the loss down to £267; in the year following there was a net profit of £1,192; last year it was £1,941, and now there was a clear profit of £5,900. Coming to the balance-sheet, the item of £8,490 for sundry creditors was virtually the same as last year; but on the other side, there were two additions to the investments. The first was £3,500 debentures in the Consolidated Supply Co. It simply meant that in place of unsecured loans of £3,500 which figured in last year's account they had taken first debentures, and so they had the best security the company could give. They had dealt with a further £5,500 which the Supply Co. owed in a similar manner, and they now held £11,500 debentures in that company out of a total issue of £12,500. Instead, however, of bringing those debentures into the accounts at face value, they had written them down by £4,500. The Canonbury business was still a disappointment, and it was very difficult to know what was best to be done with it. A general electrical manufacturing business was not easy to dispose of in face of the great depression which existed, but they had now some important negotiations in hand, and under those circumstances he would ask them not to press for any further discussion on that particular matter, as such a course would be prejudical to their interests. One thing he might tell them was, that under no conditions would they bolster up that business so as to jeopardise the other assets of the company. He had a much better account to give of the Private Wire and Telephone Installation Co., in which they held £1,000 more debentures than a year ago. Thanks to Mr. Newland, the energetic manager, that company looked as if it had really turned the corner, and would become a very valuable asset. They held £4,600 debentures and £3,000 ordinary shares, but those securities stood in their books only at the sum of £1,000. Their other investment, the Anglo-Portuguese Telephone Co., was doing particularly well, and by virtue of their controlling interest would do better in the future. It was, perhaps, unnecessary to remind them that the work of the board was not confined merely to collecting the dividends from the investments, but that by the careful utilisation of their slender resources they had succeeded in making additional profits over and above those from investments. As a matter of fact, those extra profits had paid for the whole of the administration expenses. Two years ago they had a debit balance of £983, but that had disappeared, and in addition to paying 3 per cent., and 3½ per cent. dividends, they had written £16,000 off goodwill, put £10,421 to depreciation, and now had a surplus of £5,977 to carry forward. They would all admit that was no bad record for a company making such a bad start.

Mr. C. Woolley seconded the motion.

Mr. Hibbert, in a somewhat rambling speech, complained that the chairman had told them little about the investments. They had not heard whether any dividends had been received from the Private Wire Co., and had asked them to say nothing about the Supply Co. They did know what they received from the Portuguese Co., but why should those shares not be divided up. The directors received fees in this company, and also large fees in the Portuguese Co. The Portuguese Co. paid good dividends to that company as holders of the shares, but they were only getting 3½ per cent. on their capital. He thought the company ought to be wound up.

Mr. E. Michael said he attended last year's meeting in an antagonistic spirit, and was in favour of winding up, but he had since had several talks with the chairman, and was not quite so rabid. He would, however, like to know if the board were speculating with their assets. They had £72,000 shares in the Portuguese Co., and he would object to any speculation with the assets.

The Chairman said of course they were not speculating with the assets of the company any more than was done with the assets and funds of any investment trust company. They had got rid of their manufacturing business, and they were virtually a financial trust company. They did not, however, speculate in any proper sense of the term with the funds of the company in any way. They had to invest, and the shareholders must trust them to use their best judgment. What they had done had been to the satisfaction of 98 per cent of the shareholders, and if they had confidence in them it was better not to discuss all the details of the company. The time might come for dividing the shares of the Portuguese Co., but he would ask the shareholders to trust the board in that matter. The directors were large shareholders in the company, and if from selfish motives only would do what was advantageous to the company. He was greatly impressed with the remarks of the Chairman at one of the bank meetings, who said that more harm was done to the concern by the discussion of its affairs in public than from any other cause. The Private Wire and Telephone Co. last year paid

the interest on their debentures and earned sufficient to pay 10 per cent. on the capital, but as they wanted working capital it was thought expedient that the dividend should be utilised in that way rather than that the company should find further money. The position of the Private Wire Co. was a great deal better than was disclosed by the figures before them.

The report was then carried unanimously.

United River Plate Telephone Co., Ltd.

The directors' report for the year ended March 1st, says that the gross receipts in sterling in the River Plate were £216,204, as against £181,085 last year. Deducting debenture interest, dividend on preference shares and interim dividend on ordinary shares, and adding interest on investments, transfer fees, &c., there remains a profit of £61,993, to which must be added £2,077 brought forward, making an available balance of £64,070. After putting aside £25,000 for renewal of plant and transferring the sum of £10,000 to the reserve fund, the directors recommend that a final dividend of 5 per cent. to be paid upon the ordinary share capital, making, with the interim dividend paid December 31st last, a return of 8 per cent. for the year, free of income-tax, and that the balance of £4,070 be carried forward. The directors have found it advisable to avail themselves of the powers for increasing the debenture capital of the company granted by the shareholders at the meeting of November 13th last. This necessitated the redemption of the 5 per cent. debenture stock, which was paid off on 1st inst. under the terms of the issue. The company continues to make satisfactory progress, and the directors consider the outlook favourable. The board have pleasure in announcing the appointment of Sir John Gavey, C.B., as a director.

Bombay Electric Supply and Tramways Co., Ltd.

The directors' report for the year ended December 31st, 1906, shows a capital expenditure at that date of £1,229,349. The gross receipts for the year amounted to £102,192; after deducting all expenses chargeable to revenue, including repairs and maintenance, there remains £41,900. Interest on loans and debenture interest absorb £28,056; the balance of £13,843, added to the amount brought forward from last account, £3,163, leaves a total available of £17,006. From this has to be deducted the dividend on the 6 per cent. cumulative preference shares paid to August 15th, 1906, £9,014, and the dividend on the 6 per cent. cumulative preference shares accrued to December 31st, 1906, £6,627, leaving a balance of £1,363, which the directors recommend should be carried forward. Of the reconstructed tramways 4·39 miles were working electrically. A further 3 24 miles of the reconstructed lines, and 2·73 miles of extensions, will, it is an anticipated, be opened during the month, a portion of the latter being temporarily worked by horses owing to the overhead equipment not having been completed before the monsoon broke. The electrification of the remaining routes, as well as the equipment of the extensions, will be proceeded with immediately after the monsoon. With the exception of half-a-mile, the tramways are double track throughout. The receipts per car-mile from May 7th to June 7th earned by the electric cars averaged 13·85d., as compared with an average of 8·31d. per car-mile with horses. The Local Government have, at the request of the company, passed an Act, the effect of which is to authorise the company to run at a higher rate of speed than that prescribed under the Act of 1874, which is limited to eight miles an hour, and extending, with the consent of the Corporation, the width of the carriages to be run on the tramways. Both amendments were essential on the introduction of electric traction. The extended width of the electric cars has since been sanctioned by the Corporation. The electricity supply section is developing satisfactorily, and many important installations have been completed, while others will be completed shortly. The installations connected to the mains since June, 1906, represent an equivalent of 42,560 8-c.p. lamps, making a total of 68,748 equivalent 8-c.p. lamp connections at June 14th, 1907. Since the close of the year the receipts have recorded a material and progressive increase, and have each month exceeded the expenditure.

City and South London Railway Co.—The accounts for the half-year ended 30th ult. show a balance, after providing for the debenture stock interest, the payment of the dividend on the 5 per cent. preference stock, 1891, 1896, 1901 and 1903, and the transfer to the renewal fund of £1,500, sufficient to allow the payment of a dividend on the consolidated ordinary stock at the rate of 2½ per cent. per annum, carrying forward £1,857. The dividend for the corresponding period last year was at the rate of 2¼ per cent. per annum, carrying forward £1,870.

City of London Electric Lighting Co., Ltd.—The interim report for the half-year ended June 30th, states that the number of customers being supplied was 12,233, and the number (equivalent) of 8-c.p. lamps connected was 946,986, an increase of 46,708. On the 26th ult., in addition to the lamps connected, there were 45,991 awaiting connection on completion of consumers' wiring, delivery of motors, &c., as compared with 30,014 on June 27th, 1906. The gross revenue from sale of electricity for public and private supply and meter rentals, excluding sundry receipts, was £135,776, an increase of £7,253. The net revenue (including sundry receipts) was £60,331, plus £20,621 brought forward, making £80,952. The gross revenue and net revenue are larger than for the same period in any previous year. This result is mainly attributable to the increase in the number of units sold, especially for power purposes, the total sale having been 11,856,427 units, as compared with 11,143,662 units. After payment of interest on the debenture stocks and loans, the net revenue (including £20,621 brought forward) is estimated to be about £80,952. A dividend of 5s. per share on the ordinary shares was announced in our issue of July 5th.

Metropolitan Railway Co.—The directors recommend a dividend on the ordinary stock for the past half-year at the rate of ½ per cent. per annum, carrying forward about £3,000. The dividend on the surplus lands stock will be at the rate of 2¾ per cent. per annum, carrying forward about £250. A year ago the ordinary stock received 1½ per cent., and the surplus lands stock 2¾ per cent.

County of London Electric Supply Co., Ltd.—The balance of estimated net revenue for the half-year to June 30th, after providing for debenture interest, establishment, and standing charges, shows an increase of £8,004, as compared with the same period last year. The directors have declared an interim dividend on the preference shares at the rate of 6 per cent. per annum, less income-tax, for the half-year ended June 30th, 1907, and an interim dividend on the ordinary shares of the company for the same period at the rate of 4 per cent. per annum, less income-tax, both payable on August 1st, 1907. The interim dividend on the ordinary shares for the corresponding period of 1906 was at the same rate.

Anglo-American Telegraph Co., Ltd.—The directors have resolved to declare an interim dividend for the quarter ending June 30th of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax, payable on August 1st. After paying these dividends there will be a balance of £24,143 to be carried forward. The directors point out that the securities held on account of the renewal fund have further depreciated during the past half-year.

Prospectus.—*The United Serdang (Sumatra) Rubber Plantations, Ltd.*—This company has this week been making an issue of 140,000 shares of £1 each at par. It has been formed with a view to amalgamating two estates, which have an acreage of 2,748 acres under rubber, in addition to other land under coffee cultivation.

Siemens Bros. & Co., Ltd.—According to the *Financial Times*, the directors, in their report for the year 1906, which was presented at the meeting held at Westminster last Saturday, recommended a dividend of 4 per cent., writing £9,004 off expenditure, &c., and £2,000 off the value of investments, carrying forward £5,739.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Shawinigan Water and Power Co.—Scrip (fully and partly paid) for £200,000 4½ per cent. perpetual consolidated mortgage debenture stock.

Electric Traction Co. of Hong-Kong, Ltd.—£325,000 shares of £1 each, fully-paid, Nos. 1 to 325,000.

And to allow the following to be quoted in the Official List:—

Kent Electric Power Co.—£75,000 4½ per cent. irredeemable debenture stock (special application).

The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Madras Electric Tramways (1904), Ltd.—Further issue of £11,000 5 per cent. debenture stock.

German Investments Abroad.—The report for 1906 of the Berlin Company for Electrical Enterprises (Gesellschaft fur Elektrische Unternehmungen) states that almost all the undertakings in which the company is interested have shown improved results for the past year, and particularly the foreign trusts as represented by the Buda Pesth Company for Electrical and Transport Enterprises, and the Société Financière de Transports et d'Entreprises Industrielles of Brussels. A list is given of the principal shares disposed of during 1906, whilst the new acquisitions include shares in the Anglo-Argentine Tramways Co., the Bilbao Tramways and Electricity Co., and the Victoria Falls Power Co. The company's portfolio contains shares in the British Thomson-Houston Co., and in Swiss companies, and also in undertakings in Belgium, Austria-Hungary, Russia, Denmark, Norway, Bulgaria, and the Argentine Republic; and numerous German concerns are also included within the scope of this comprehensive investment company. Its ordinary share capital amounts to £1,875,000, and the bonds to £1,725,500, making a total of £3,600,500. The net profits arising from interest on and sale of investments reached £183,795 in 1906, as compared with £140,245 in the preceding year. A dividend has been declared at the rate of 8 per cent. as contrasted with 7½ per cent. in 1905, 6 per cent. in 1904, and 3 per cent. in 1903. The reserve funds amounted to £134,500 at the end of 1906.

Telegraph Construction and Maintenance Co.—The directors recommend an interim dividend of 12s. per share.

Notting Hill Electric Lighting Co., Ltd.—The directors have declared an interim dividend of 3 per cent. on account of the year 1907.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £	No. of wks.	Total to date. £	Total to date. £	Route miles open.	Inc.
Aberdeen	July 10	3,056	— 33	6	8,415	— 290	14·4	..
†Ayr	,, 6	851	— 60	8	2,294	— 209	8	..
Bath	,, 6	1,657	— 292	28	20,839	— 849	13	..
Belfast	,, 13	8,196	+ 615	15	54,406	+ 3,341	40	..
Birkenhead	,, 14	2,242	— 139	15	15,599	— 467	13·52	..
Birmingham Corp.	,, 13	12,141	..	15	89,378	..	56·15	..
Blackburn	,, 10	2,164	— 83	15½	16,941	+ 535	14·13	..
†Blackpool Corp. ..	,, 12	1,549	+ 17	..	14,077	— 1,548	11·67	..
,, —Fleetw'd.	,, 13	1,677	— 211	2	1,677	— 211	8·25	..
Bolton	,, 14	4,579	+ 71	15	33,864	+ 943	26	..
Bournemouth ..	,, 10	3,364	— 30	14½	23,947	— 155	21·5	2½
Bradford	,, 13	9,335	— 152	15	69,391	— 471	53	..
Brighton	,, 14	1,935	— 208	15	13,388	— 1,359	9·5	..
Bristol	,, 12	10,581	— 882	..	..	..	29·5	..
Brit. Elec. Trac. Co.								
Airdrie	,, 5	462	— 1	26	5,856	— 8	3·65	..
Barnsley	,, 5	810	— 5	,,	4,275	— 17	..	..
Barrow	,, 5	589	— 7	,,	6,235	— 98	5·87	..
Cavehill	,, 5	161	— 25	,,	1,996	— 58	..	..
Devonport	,, 5	2,220	+ 22	,,	11,700	+ 56	8·85	..
Gateshead.. ..	,, 5	516	+ 65	,,	26,123	+ 908	11·25	..
Gravesend ..	,, 5	1,594	— 66	,,	6,086	— 18	6·5	..
Greenock	,, 5	658	— 43	,,	17,112	— 192	7·25	..
Hartlepool	,, 5	290	— 69	,,	7,078	— 428	6·72	..
Kidderminster ..	,, 5	230	+ 1	,,	2,818	— 113	..	..
Leamington ..	,, 5	428	— 299	,,	3,909	— 286	3	..
Merthyr	,, 5	9,968	+ 19	,,	5,902	+ 274	2·9	..
‡Metropolitan ..	,, 5	725	+2,407	,,	118,442	+25,815	22	..
Middleton.. ..	,, 5	11,685	— 83	,,	8,937	— 167	8·5	..
Mid. Joint Com'tee	,, 5	1,157	+ 6	,,	148,821	+ 1,662	..	..
Oldham — Ashton	,, 5	249	+ 13	,,	15,549	+ 745	9·18	..
Peterborough ..	,, 5	3,984	— 40	,,	3,021	— 96	5·81	..
Potteries	,, 5	667	+ 108	,,	48,498	+ 1,199	29	..
Rothesay	,, 5	689	— 127	,,	3,404	— 445	2·75	..
Southport	,, 5	1,662	— 43	,,	7,100	+ 499	8·17	..
S. Metropolitan ..	,, 5	1,631	+ 767	,,	19,418	..	..	..
Swansea	,, 5	777	— 20	,,	21,689	+ 480	5·5	..
Tynemouth	,, 5	370	— 81	,,	5,297	— 737	3·75	..
Weston-s-Mare ..	,, 3	622	— 120	,,	2,068	+ 294	3	..
‡Worcester.. ..	,, 5	213	— 35	,,	6,891	— 191	5·75	..
Wrexham	,, 5	1,896	— 8	,,	2,592	— 36	..	..
Yorks. Wool. Dist.	,, 5	521	+ 43	,,	24,720	+ 172	17	..
Miscellaneous ..	,, 5	2,518	— 7	,,	5,597	— 114	..	..
Burnley	,, 13	586	— 199	..	..	..	7·5	..
Burton-on-Trent ..	,, 14	2,293	— 58	15	4,290	— 315	10	1·5
Bury	,, 14	2,158	..	15	16,321	..	10·5	..
Cardiff	,, 6	442	— 71	14	29,066	— 121	15·87	..
Carlisle	,, 13	1,628	— 28	28	4,609	— 377	..	..
Chatham and Dist.	,, 11	1,165	+ 141	28	19,060	+ 1,543	12·84	2·55
Cork	,, 11	2,950	— 30	28	12,456	— 436	8·89	..
Croydon	,, 12	June 22	— 280	15	21,374	— 1,532	12	·75
Darlington	June 22	225	+ 13	12	2,537	+ 16	..	..
†Darwen	July 12	268	— 9	15	3,889	— 30	4·36	..
Dover	,, 13	561	— 70	15	3,422	— 436	4·75	..
Dublin	,, 12	12,134	+2,837	24	12,189	+ 2,907	54·25	5·5
Dundee	,, 10	2,276	+ 52	8	9,058	+ 299	13	·5
East Ham	,, 13	1,908	— 49	15	13,783	— 450	8	..
Exeter	,, 12	666	— 53	15	4,716	+ 376	4·75	·5
Glasgow	,, 13	34,696	+ 712	7	109,605	— 2,206	89·75	9·5
Hastings	,, 11	2,811	..	..	..	..	..	..
Huddersfield ..	,, 13	3,137	+ 72	14	23,728	+ 783	98	..
Hull	,, 13	4,858	+ 152	15	25,719	+ 1,888	13	..
Ilkeston	,, 10	979	— 6	15	2,115	+ 141	3·5	..
Ipswich	,, 13	902	— 55	15	5,978	— 511	10·5	..
Isle of Thanet ..	,, 13	1,881	— 342	28	11,943	— 455	11	..
Kilmarnock ..	,, 11	2,569	+ 712	28	30,992	+ 6,795	15·82	3·26
Lan'kshire Trm. Co.	,, 10	2,657	+ 434	28	33,361	+ 8,870	38·5	9
Lancashire United	,, 13	13,460	+ 52	16	97,670	+ 3,425	96	6·5
Leeds	,, 13	4,405	— 251	..	..	..	..	..
Leicester	,, 6	593	+ 3	7½	4,030	— 74	6	..
†Leith	,, 6	32,438	— 193	27	287,352	+ 8,390	104	..
Liverpool	,, 6	63,506	+10,330	14	433,607	+65,886	116·4	19·9
‡L.C.C.	,, 6	15,089	+ 608	24	169,250	+ 2,799	..	..
London United ..	,, 13	480	+ 35	41	6,727	+16,757	172	20
Lowestoft	,, 13	30,245	+1 300	16	219,415	+ 282	..	..
Manchester	,, 13	7 871	+1,153	15	63,019	+ 1,423	14·5	..
Newcastle	,, 13	1,380	+ 26	15	10,947	— 316	5·5	..
Newport	,, 12	896	— 113	14½	6,436	+ 1,907	3·75	..
Northampton ..	,, 14	3 884	+ 150	16	30,636	+ 1,393	5	1·5
Oldham	,, 13	527	+ 198	15	3,990	— 1,360	14·5	..
Pontypridd	,, 13	4,341	— 575	15	29,289	..	..	..
Portsmouth	,, 10	1,577	— 35	..	..	..	..	..
Preston	,, 4	610	— 68	13½	8,365	— 386	13·25	..
†Reading	,, 11	1,199	+ 186	14½	8,660	+ 1,289	10	·66
Rotherham	,, 15	9,529	+ 113	15	71,022	+ 1,243	38·9	..
Salford	,, 14	11,174	+ 363	16	88,094	+ 3,682	36·75	..
Sheffield	,, 10	2,119	— 29	14	14,4 3	+ 317	..	..
Southampton	,, 10	889	— 92	15	5,818	— 345	..	..
Southend-on-Sea ..	,, 14	2,928	— 226	15	21,307	— 164	..	..
Sunderland	June 26	319	+ 4	..	..	..	4·4	..
Swindon	July 13	1,102	— 56	26	12,722	+ 554	8·87	..
Tyneside	,, 13	1,766	— 42	15	12,456	+ 165	8·72	·05
Wallasey	,, 6	662	— 28	14	8 551	— 248	9	..
Walthamstow ..	,, 11	4,783	— 68	15	36,631	+ 930	14·7	..
West Ham	,, 10	1,760	— 21	14	12 619	+ 168	20	..
Wolverhampton ..	,, 14	2.275	+ 699	28	31,295	..	..	..
Yorks. W. Riding ..	,, 13	5,880	+2,494	2	5,880	+ 2,494	4	·75
Baker St.-Waterloo	,, 13	11.489	— 538	2	11,489	— 538	6	..
Cen. London Rly.	,, 13	5,845	..	2	5,845	..	8	..
†Char. +, Eus. Hmp.	,, 14	6 436	+1,507	2	6,436	+ 1,507	7 24	1
City & S. Lon. Rly.	,, 12	220	— 11	2	220	— 11	7	..
Dublin-Lucan Rly.	,, 13	3.456	+ 60	2	3.456	+ 60	3·5	..
G.N. and City Rly.	,, 13	8.845	..	2	8 845	..	9	..
G.N., P'dy. & Brmp.	,, 14	3,217	+ 99	2	3,217	+ 99	6·4	3·9
L'pool Overh'd Rly.	,, 13	3 871	+ 591	2	3,871	+ 591	4·5	..
Mersey Railway ..	,, 14	32.107	+1,628	2	32 107	+ 1,628	24·6	..
Metropolitan Rly.	,, 14	16,339	+ 127	2	16,339	+ 127	24	..
Met. District Rly.	,, 14	33,193	+3,947	28	461,427	+46,576	42	..
Anglo-Argentine ..	,, 15	10,248	+ 457	20	53,380	+ 3	19·2	·55
‖Auckland	May	12,500	+ 905	..	..	..	..	..
‖Brisbane	June	26,123	+7,590	52	271,462	+56,121	..	..
‖Brit. Columbia Rly.	May	9,347	+ 290	9	14,647	+ 1,859	..	..
Bu'n's A'r's E.T.Co.	Mar. 2	5,911	+ 314	16	60,226	+ 4,091	..	..
†Bu'n's A'r's-Blgr'no	Apr. 21	6,324	+ 372	..	..	..	..	..
Calcutta	July 13	12,710	..	..	..	..	..	..
§Cape Electric T. Ld.	May	8.840	+ 435	..	..	..	..	..
‖Geneva	June	4,207	..	25	23,752	..	20·5	..
‖Kalgoorlie, W.A...	,,	7,540	+ 170	28	24,706	+ 2,002	12·75	2·25
Madras	July 15	836	..	..	..	..	..	..
‖Lisbon	May	2,594	— 196	27½	40,181	— 1,363	25·6	·4
Perth (W.A.) ..	July 12							

* Compared with the corresponding period of 1906. † One week only.
‡ Includes horse, steam and other receipts ‖ One month.

STOCKS AND SHARES.

Tuesday Evening.

In many markets the disposition of prices to mend is more than maintained. For one reason and another, investment business has quickened into something like cheerfulness, a welcome change after the torpor of months. Railway stocks are in better demand, investment sections such as those devoted to Telegraph and Telephone and Traction descriptions find that public inquiry is astir for cheap stock. That the improvement should come on the eve of the holiday season is still regarded as sufficiently curious for doubts to be cast upon the staying capacity of the buyers, but the Chancellor of the Exchequer has ranged himself upon the side of the bulls, and we have no hesitation in following so august an example.

Narrow markets make for sharp fluctuations. City and South London Ordinary stock have touched 50, although the amount dealt in did not exceed a comparatively few thousands of stock. A good proportion of buying was in small sums, two, three or four hundred pounds stock at a time, showing the small investor to be at work. Prophecies as to the dividend had been very optimistic, tempered by gentle deprecation on the part of those who, perhaps, had sold and wanted to re-purchase. The actual result, at the rate of 2½ per cent. against 2¼ per cent., is certainly good. From a correspondent in close touch with the inner working of the company, we have received an estimate that the dividend for the second half of the current year can be raised to 3½ per cent. if the takings average a weekly increase of £550 throughout the period.

The Metropolitan Railway dividend, at the rate of ½ per cent. on the Ordinary stock, was about what had been expected. After varying between 48 and 45½, the price settled down to 47 on the announcement. Central Londons were quiet, and a good deal of curiosity has been felt as to whether the regular 4 per cent. dividend on the Ordinary would be maintained. Districts rose to 13½, only to lose the fraction.

British Electric Traction Preference rallied to 7½, but Potteries Electric Tractions went weak. The Ordinary fell to 7s., and the Preference have been changing hands at half a sovereign and half a guinea.

Negative terms continue to be the only appropriate descriptions for Electric Lighting shares. The few dividends declared for the half-year are fair, but they caused no improvements, and the market is very dead. Two or three changes have occurred, but so small as to be of no real account. The Electric Construction report, showing the dividend on the Preference shares to have been passed, was ignored as an unfavourable point; indeed, the Ordinary shares from 4s. rose to 5s. To explain this, the argument is advanced that the company has been passing through times abnormally bad, and that better fortune may be looked forward to with confidence.

Crompton's rose to 2 upon the doubling of the dividend. Telegraph Constructions are unchanged upon the declaration of the 12s. interim dividend, the same amount as before.

Great enthusiasm amongst the bears greeted the anxiously-awaited statement of the Anglo-American Telegraph Company. The figures, showing a carry-forward of £24,000 after provision for the usual dividends on the Ordinary and Preferred stocks, were as good as anyone anticipated. But the sting lay in the tail of the announcement, the directors pointing out that further depreciation had occurred in the company's investments. This the bears joyfully interpreted to mean as a warning note as to the next dividend on the Deferred stock, and the price fell from 22¾ to 19⅞. At this point a rally ensued, but the quotation is still heavily down on the week. The Direct United States declared 1s. 6d. less than the market anticipated. After the first drop, however, there came a fair recovery.

Otherwise, the Telegraph department is firm, with a sprinkling of small improvements down the list. The National Telephone group remained steady, though the 4 per cent. Debenture eased off a shade. River Plate Telephones at 7¼ are the fraction higher.

Direct United States Cable Co., Ltd.—The directors recommend a final dividend of 4s. per share, and a bonus of 2s. 6d. per share, both free of income-tax, payably on and after the 31st inst., making, with the three interim dividends already paid, a total distribution of 4⅝th per cent. for the year ended June 30th last, and after placing £15,000 to reserve fund account, carrying forward a balance of about £2,515. The transfer books are closed from 12th inst. to 26th. The total dividend for the previous year was 4¼ per cent.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations July 9th.	Closing Quotations July 16th.	Business done week ended July 16th, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	..	..	..	Nil
149,600	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	5 %	5 %	86 — 89	86 — 89 xd	..	..	..	5 12 4
660,660	Anglo-American Telegraph	Stock	61s.	2⅞%	3½%	3⅞%	62 — 65	62 — 65	64½	..	..	5 19 3
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	5⅝%	6 %	6 %	108½—109½	109 —110	109⅝	108½	+ ⅜	5 9 1
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	¼%	1¾%	21½— 22½	20½— 20⅝	22⅝	19⅞	—1½	8 8 8
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	..	100 —103	100 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	8 %	6½— 7½	6½— 7½	..	..	..	5 10 4
2,097,680	Commercial Cable Sting. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	93⅜	92¼	..	4 5 1
16,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	7½— 8½	7⅜ ..	..	..	— ¼	6 1 3
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	15½— 16½	15½— 16½	..	..	..	5 19 5
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3½— 3¾	3⅜— 3¾	..	..	..	5 8 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8½— 9½	8⅝— 9½	..	..	..	5 8 1
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	98 —101 xd	..	..	..	4 9 1
60,710‖	Direct United States Cable	20	3 %	3½%	4½%	4⅝%	15½— 16½	15⅝— 16	15⅛	15⅛	— ⅛	5 19 6
57,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	98 —100	98 —100 xd	99½	..	..	4 10 0
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	135 —140	135 —140	138½	137½	..	5 0 0
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	89 — 91	88 — 90	89½	88½	—1	3 17 9
1,896,705	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 —105	103 —105	103⅛	..	..	3 16 2
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	13 — 13½	13⅛— 13⅜	13¼	13⅛	+ ⅛	5 2 9
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	104 —106	104 —106	104½	104	..	3 15 6
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
200,000‖	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
181,127	Globe Telegraph and Trust	10	5½%	5⅝%	5½%	5½%	10½— 11	10⅝— 11½	11	10⅝	— ⅛	5 2 4
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13½— 14	13⅝— 14½	13½	13½	+ ⅛	4 4 11
150,000	Great Northern Telegraph, of Copenhagen ..	10	15 %	24 %	24%	20 %	34 — 36	33½— 35½	33½	..	— ½	5 12 8
28,900	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	98 —100	98 —100 xd	..	..	..	4 10 0
17,000	Indo-European Telegraph	25	10 %	13 %	13 %	13 %	56— 58	56 — 58	57¼	..	..	5 12 1
$41,380,400	Mackay Companies Common	$100	..	1 %	2 %	3⅜%	66 — 68	66 — 68 xd	..	..	..	5 2 11
$50,000,000	Do. do. 4% Cum. Pref.	$100	..	4 %	4 %	4 %	67 — 69	67 — 69 xd	..	..	..	5 15 11
256,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜— ⅝	⅜— ⅝	14/4½	..	— 1/16	Nil
72,680	Monte Video Telephone Co., Ltd. Ord. ..	1	3 %	4 %	5 %	..	1⅛— 1 1/16	1⅛— 1 1/16	..	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	⅞— 1	⅞— 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	109 —111	109 —111	110½	109½	..	5 8 1
2,225,000	Do. do. Def. Stock	100	5 %	5 %	5 %	5½%	108 —110	108 —110	109½	108½	..	5 0 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	11½— 13½	11½— 13½	..	..	..	4 8 11
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	..	..	..	4 3 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 11/16	5 7/16— 5 11/16	5⅝	5 11/32	..	4 7 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	94½— 96½	94½— 96½	96¼	..	..	3 12 6
1,689,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100½—102½	100 —102	102¼	100⅞	— ⅛	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6½%	6¾%	7 %	7 %	1½— 1⅝	1½— 1⅝	..	..	..	5 1 10
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/16	1 1/16— 1 1/16	..	..	..	4 14 5
100,000	Do. do. do. 4 % Red. Deb. Stock ..	100	..	..	4 %	4 %	93 — 96	93 — 96 xd	..	..	..	4 3 4
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	97 —100	97 —100 xd	..	..	..	4 0 0
11,839‖	Reuter's	8	5 %	5 %	5 %	5 %	7⅞— 8½	7 — 8	..	..	— ½	5 0 0
60,000	Telephone Co. of Egypt, 4½ % Deb. Red. ..	100	..	..	4½%	4½%	97 —100	98 —101 xd	..	..	..	4 10 0
3,167	Submarine Cables Trust	Cer	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
80,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6¾— 7¼	7 — 7½	7⅛	..	+ ⅛	5 6 8
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 11
15,60?‖	West African Telegraph, Shares	10	4 %	4½%	4 %	4 %	10 — 10½	10 — 10½	..	..	..	3 16 2
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2	Nil	Nil	Nil	2½%	1¼— 1⅝	1¼— 1⅝	..	..	..	3 12 9
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	97 —100 xd	..	..	..	3 18 5
207,330	Western Telegraph, Ltd., Nos. 1 to 207,330. ..	10	7 %	7 %	7 %	..	13⅜— 14⅛	13⅜— 14⅛ xd	13⅝	..	..	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —103	100 —103 xd	..	..	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅛— ⅜	..	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %†	6 %	5 %	8 %	7½— 7¾	7⅝— 7⅞	..	..	+ ⅛	10 5 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	6½— 7⅛	6½— 7⅛	..	..	..	Nil
80,000‖	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	5 %	100 —103	100 —103 xd	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007	5	..	8 %	8 %	8 %	8 — 8½	8½— 8⅝	8 7/16	8 5/16	+ ⅛	4 12 9
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007	5	5½%	5½%	5½%	5½%	6 — 6¼ xd	6 — 6¼	6⅛	6 1/16	..	4 8 0
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	131 —134	131 —134 xd	..	..	..	4 9 7
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105 xd	10⅛	103	..	4 15 8
830,000	Babcock & Wilcox, 1 to 830,000	1	17 %	20 %	20 %	20 %	3⅜— 4	3⅜— 4	78/1½	..	..	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜— 1½	1 7/16— 1 9/16	..	..	+ 1/16	3 16 10
38,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	7 %	5 — 5¼	5 — 5¼	..	..	..	6 7 3
40,000	Do. do. 7 % Cum. Pref.	5	Nil	7 %	7 %	7 %	5¼— 5⅜	5¼— 5⅜	..	..	..	6 1 9
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	6 %	5¼— 5⅜	5 — 5¼ xd	..	..	..	5 9 1
20,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	4 %	3¾— 4¼	3¾— 4¼	..	..	..	4 14 1
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	4 17 1
300,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	98 —101	98 —101	..	..	..	5 8 11
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	6 %	6 %	120 —125	123 —128	127½	126	+3	4 13 9
300,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	107 —111	108 —112	111	110	+1	4 9 3
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	103 —107	101 —104	102⅜	..	—2½	4 16 2
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	99 —102	100 —103	102¼	..	+1	4 7 5
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	103 —105	101 —103 xd	..	..	..	4 5 9
133,301	British Electric Traction	10	6 %	6 %	3 %	Nil	2⅞— 3¼	2⅞— 3¼	57/6	56/3	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %	7 — 7½	7¼— 7⅜	7⅜	7 3/4	+ ⅛	7 14 10
1,448,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	103 —106	100 —103	102	100¾	—3	4 17 1
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	4½%	78 — 81	78 — 81	..	..	..	5 11 1
100,000	British Insulated and Helsby Cables ..	5	8 %	8 %	8 %	10 %	6¾— 6⅞	6¾— 7	..	..	+ ⅛	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6¼— 6⅜	6¼— 6⅜	..	..	..	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	101 —104 xd	101 —104	103	102½	..	4 6 7
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	89 — 93	89 — 93	..	..	..	4 16 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1 — 1½	1 — 1½	..	..	..	Nil
1,016,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	55 — 60 xd	58 — 63	..	..	+3	6 7 0
50,000	‡ Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅞— 1⅛	⅞— 1⅛	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	2½%	Nil	½— ¾	½— ¾	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	Nil	½— 1½	½— 1½	..	..	..	Nil
125,000‖	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	88 — 91	88 — 91	..	..	..	4 18 11
125,000‖	Do. do. 4½ % Perp. 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	71 — 74	71 — 74 xd	..	..	..	6 1 7
100,000	Buenos Ayres & Belgrano, 1 to 100,000 ..	5	3 %	4 %	3 %	3 %	4⅛— 4 5/16	4⅛— 4⅜	85/7½	82/6	+ 1/16	3 8 7
40,000	Do. do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	4⅜— 5⅛	4⅜— 5⅛	..	..	..	5 14 3
27,500	Do. do. "B" do., 1 to 27,500	5	6 %	6 %	6 %	6 %	4¼— 5⅛	4¼— 5⅛	97/6	97/-	..	5 14 3
13,200	Do. do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	105 —115	105 —115 xd	..	..	..	4 6 11
190,000	Do. do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	100 —103	101 —103 xd	..	..	..	4 17 1
137,610	Calcutta Trams, 1 to 137,610	5	6 %	8 %	8 %	8 %	7¼— 7⅜	7¼— 7⅜	7⅜	7½	..	5 3 3
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330.	5	..	..	5 %	5 %	5¼— 5⅜	5¼— 5⅜	..	..	..	4 6 11
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	102 —106	102 —106	104½	103½	..	4 4 11
85,000	Callender's Cable Construction shares	5	12½%	12½%	15 %	15 %	9½— 10½	9½— 10½	10	..	..	6 13 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝ xd	..	..	..	4 8 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105½—107½	105¼—107½ xd	..	..	..	4 8 9
491,222	Cape E. Trams., 1 to 491,222	1	10 %	5 %	Nil	..	1/16— 1/16	1/16— 1/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	8 %	1 1/16— 1 1/16	1 1/16— 1 1/16	..	..	..	6 1 11
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	97 —102	97 —102	99½	..	..	4 8 3
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	73 — 75	73 — 75	74⅛	..	..	5 6
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	..	..	..	4 5 1
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	53 — 56	53 — 56	55	..	..	7 2 10
1,480,000	City and South London Railway	Stock	2⅜%	2⅜%	1⅞%	2⅛%	47 — 49	49 — 51	50½	48⅜	+2	4 3 4
85,000	Crompton & Co., Nos. 1 to 85,000	3	2⅛%	2⅛%	2⅛%	5 %	1⅛— 2 1/16	1⅞— 2⅛	40/7½	40/-	+ 1/16	7 2 10
100,000‖	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	93½— 96½	93½— 96½ xd	..	..	..	5 3 8

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

(Continued on next page.)

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations July 9th.	Closing Quotations July 16th.	Business done week ended July 16th, 1907.		Rise + or Fall —	Present Yield per cent.
		*	1903.	1904.	1905.	1906.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	...	10 %	10 %	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	6 3 1
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	..	1 — 1¼	1 — 1¼	..	..	..	4 16 0
294,150	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103 xd	100⅝	..	..	4 7 5
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5⅝%	6 %	6%	..	13⅜ — 14½	13⅜ — 14½	..	..	..	4 2 9
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	13 — 14	13 — 14	..	..	..	4 9 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	N	2½%	4½%	..	1¼ — 1⅜	1¼ — 1⅜	25/7½	..	..	9 1 10
17,139	Do. "A" shares, 01—017,139	5	N	2½%	4½%	..	2¼ — 2⅜	2¼ — 2⅜	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	83 — 85 xd	83 — 85 xd	..	..	..	4 14 2
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	89 — 92	89 — 92	..	..	..	5 8 8
112,100	Electric Contruction, 1 to 112,100	2	4 %	Nil	Nil	..	3/16 — 7/16	3/16 — 7/16	3/9	..	+ 1/16	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	1¼ — 1⅜	1¼ — 1⅜	..	..	..	8 0 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	4 %	5 %	5 %	5 %	8 — 8⅛	8 — 8⅛	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	92 — 95	92 — 95	..	..	..	5 14 3
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	3 %	4 %	4 %	4 %	2 — 2⅛	2 — 2⅛	45/-	43/9	..	20 0 0
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10¼ — 10⅜	10⅛ — 10⅜	..	..	..	6 13 4
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	11⅜ — 12⅛	11⅜ — 12⅛	..	..	..	6 0 0
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	3 17 3
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105⅛—107⅛	105⅛—107⅛	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	5 %	10%	10 %	15 — 16	15 — 16	15⅛	..	..	6 5 0
37,500	†Liverpool Overhead Railway, Ord.	10	1⅜%	1½%	Nil	Nil	1⅜ — 1⅝	1½ — 1⅝	..	..	+ ⅛	Nil
10,000	† Do. do. Pref., £10 paid	10	5 %	5 %	5 %	5 %	6¼ — 7⅛	6¼ — 7⅛	..	..	..	6 13 4
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	6 %	3 %	3 %	6¼ — 7⅛	6¼ — 7⅛	..	..	..	3 8 7
399,930	Do. do. 60,008 to 100,000	10	8 %	6 %	3 %	3 %	6¼ — 7⅛	6¼ — 7⅛	..	..	..	5 2 2
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛xd	8⅛	..	..	5 14 3
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	84 — 88	84 — 88	..	..	..	4 10 11
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	3/32 — 5/32	3/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/32 — 5/32	3/32 — 5/32	..	..	..	4 12 9
350,000	Do. do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	94 — 97 xd	94 — 97 xd	94⅛	94½	..	4 10 11
30,000	Peebles (B.) & Co., 6 % Cum. Pref., 20,001 to 50,000	5	..	6 %	6 %	6 %	3⅞ — 4¼	3⅞ — 4¼	..	..	..	7 2 3
245,500	Potteries E. Tro.	1	5 %	5 %	4 %	4 %	1/16 — 3/16	1/16 — 3/16	..	..	— 1/16	6 8 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/16 — 5/16	3/16 — 5/16	10/-	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	96½	..	..	4 11 10
37,350	Telegraph Construction and Maintenance	12	20 %	15 %	15 %	15 %	31 — 33	31 — 33	33	..	..	5 9 1
150,000	Do. 4 % Ded. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99 —102	99 —102 xd	..	..	..	3 18 5
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	5 %	5 %	5 %	62 — 65	64 — 67	..	..	+2	7 9 3
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	3 %	Nil	Nil	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	Nil
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3¼ — 4	3¼ — 3¾	..	..	— ¼	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	77 — 81	77 — 81	76	..	..	4 18 9

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	5 %	5⅛%	5⅛%	5⅛%	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	5 4 9
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10%	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	6 1 3
10,202	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 2 4
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	8 %	8 %	5 %	5 %	3⅞ — 4	3⅞ — 4	80/-	77/6	+ ½	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3⅞ — 4¼	4 — 4⅛	86/3	..	+ ¼	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4¼	3⅞ — 4⅛	..	..	— ⅛	5 9 1
427,400	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
49,436	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	3¾ — 4¼	3⅝ — 4⅛	..	..	+ ⅛	5 0 0
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 —104	102 —105	..	..	+1	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	9 — 10	9 — 10 xd	9⅛	9	..	6 0 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅛ — 12⅛	11 — 12	..	..	— ⅛	5 0 0
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	120⅛—123⅜	120⅛—123⅜	..	..	..	4 1 0
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
40,000	County of Durham Electrical Power, Ord.	5	4 %	£3 7 0	4 %	4 %	4½ — 5	4½ — 5	..	..	..	4 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	5 0 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4⅛%	5 %	5 %	7⅛ — 8⅛	7 — 8	7⅞	7½	— ¼	6 5 0
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅜	10⅜ — 11⅜	11 1/16	11⅛	..	5 4 4
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	93 — 96	93 — 96	94⅛	93½	..	4 13 9
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	4 %	..	¾ — 1	¾ — 1	..	..	..	11 0 0
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	1 — 2	1 — 2	30/-	25/-	..	15 0 0
350,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	78 — 83	76 — 81 xd	..	..	—2	5 11 1
10,000	Folkestone, 1 to 10,000	5	5⅛%	5⅛%	5⅛%	5⅛%	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	5 8 5
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 15 3
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
13,000	Hove, 1 to 13,000	5	8½%	8½%	9 %	9 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	6 4 2
21,000	Kensington and Knightsbridge Electric Ord.	5	12%	12 %	10 %	10 %	8¾ — 9⅛	8⅝ — 9⅛	..	..	..	5 0 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 5 1
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	3 %	4 %	4 %	1⅞ — 2⅛	1⅞ — 2⅛	..	..	— ⅛	5 12 3
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	5 17 1
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	93 — 96	93 — 96	..	..	..	4 13 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8⅜%	10 %	10 %	8 %	5⅜ — 6⅜	5⅜ — 6⅜	..	..	..	5 14 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 5 9
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	103 —107	103 —107	..	..	..	4 4 1
250,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	86 — 91	86 — 91	..	..	..	3 16 11
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	8 %	7⅛ — 7⅜	7⅛ — 7⅜	..	..	..	5 3 3
75,000	Do. 5 % Pref., 1 to 75,000	5	5 %	5 %	5 %	5 %	6 — 6⅛	6 — 6⅛	..	..	..	4 3 4
10,852	Notting Hill Electric Lighting	10	6 %	7 %	7½%	7½%	12 — 13	11¼ — 12¼	..	..	— ⅛	6 0 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6⅜%	7 %	7 %	7 %	5⅜ — 6⅛	5⅞ — 6⅛	..	..	+ ⅛	5 9 11
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	96 — 99	96 — 97	..	..	—1	4 2 6
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14⅜%	14⅜%	12½%	10 %	8 — 9	8 — 9	..	..	..	5 11 1
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6¼ — 7⅛	6¼ — 7⅛	..	..	..	4 13 4
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3 %	3½%	86 — 91	86 — 91	..	..	..	3 16 11
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	1 — 2	⅜ — 1⅛	..	..	— ½	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	73 — 77	73 — 77	..	..	..	5 3 11
65,000	South London Electricity Supply, Ord.	5	3 %	4 %	4 %	5 %	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	Nil	2½%	2½%	⅜ — ⅝	⅜ — ⅝	15/-	..	..	3 6 8
117,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 1 10
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	11 2 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	2 — 3	2 — 3	55/-	..	..	8 6 8
200,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	..	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
110,000	Westminster Electric Supply, Ord.	5	13⅛%	14 %	13 %	12 %	9 — 10	9 — 10	..	..	..	6 0 0
81,279	Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1905)	5	5 %	5 %	5 %	4½%	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 0 0

* Unless otherwise stated, all shares are ully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4 per cent., April 25th, 1907

THE ENGINEERING CONFERENCE.

(*Continued from page* 74.)

Machine Tool Design as affected by the Use of High-Speed Cutting Tools.

The advantages of more rigid and powerful machine tools for high cutting speeds were set forth in Sec. III (Machinery) by Prof. John Thomas Nicholson, D.Sc., M.Inst.C.E., on Thursday, June 20th. The section of the cuttings removed by high-speed steel is not considered by the author to be greater than has been customary with the ordinary carbon steel tools, the speed only has been increased according to Prof. Nicholson, and rates of 30 ft. and 150 per minute are given for heavy and light cuts respectively, against 10 and 20 ft. per minute with old-fashioned tools. Naturally the power required has been proportionately increased resulting in larger pulleys and higher belt speeds. Another point worthy of attention is the ratio between the highest and lowest spindle speeds, which is much reduced when high-speed cutting tools are used.

Prof. Nicholson advocates solid bush-bearings for fast headstocks in conjunction with forced lubrication, he also condemns the H section bedplate and urges the necessity of bolting down loose headstocks at their four corners, instead of securing them in the centre as at present.

We are inclined to think that the demand for increased stiffness in machine tools has been caused mainly by the tendency towards heavier cuts and higher speeds, which was apparent long before high-speed steel came to the front, and that the latter has only emphasised a long-felt want.

More stress might also have been laid upon the advantages of increasing the output of machine tools. Manufacturers do not always realise the actual cost per hour of machine work, and the customary method of estimating shop charges as a percentage on the labour is not calculated to bring to their notice the losses caused by inefficient machinery. Many years ago shop charges were lumped together with the labour, in obtaining prime costs for machine work, each tool being rated at a sufficient hourly charge to cover the cost of power, repairs, stores, capital charges and labour. This plan has the advantage of showing much more clearly the saving which would be effected by increasing the output of any machine tool, and in the improved form, introduced by Mr. Hamilton Church (*Engineering Magazine*, July to December, 1901) this method is being used in several large engineering undertakings. To take a simple example, we will suppose a large machine tool to be rated at 5s. an hour, based upon a working year of 3,000 hours. It is, however, of old-fashioned design, and lacking the stiffness and power necessary for the high speeds and heavy cuts allowed in up-to-date practice. According to the figures already given, we might expect to obtain at least four times the output from a modern machine running for full time throughout the year. This is not, however, the case, as a considerable amount of time is taken up in setting new work, and possibly both man and machine may be totally idle at intervals if new jobs are not ready for starting on the moment the old ones are taken off, hence the output will not be increased quite in proportion to the increased cutting speed. The machine rate in this instance brings home to us very strongly the two following points; firstly, that the increased output will easily cover the capital charges and extra power cost for a new machine and leave a handsome margin of profit; secondly, the importance of waiting on the machine-man hand and foot, so that as little time as possible may be lost in starting on a new job, or running about for new tools. This aspect of the subject is being fully appreciated by several up-to-date firms, but there are still many others who fail to realise the losses caused by the retention of old tools which should long since have found their way to the scrap heap.

Dock Equipment, Including the Relative Advantages of Electric and Hydraulic Appliances.

This paper, read by W. W. Squire, M.Inst.C.E. (Section II.—Harbours, Docks and Canals, Thursday, June 20th, 1907), deals with a subject which has been so thoroughly discussed at previous conferences and in other papers, that neither the author of the paper nor those who took part in the discussion could add anything particularly new or of special interest.

The author's preference appears to be rather in the direction of electricity, although for the opening and closing of dock-gates and large sluices he states that the advantage is decidedly in favour of hydraulic gear, an opinion with which we feel that we cannot agree. In many instances, both in this country and abroad, large slow-moving objects, such as swing bridges, bridges of the Scherzer rolling type, &c., are being worked both economically and satisfactorily by electric gear, and the time is quite past for this class of work to be regarded as the special preserve of the hydraulic engineer.

In some cases—as, for instance, on cranes handling heavy loads and requiring fine adjustments—the advantages of electric and hydraulic gear may be combined, as in the case of the very fine electro-hydraulic cranes at the Swindon locomotive works. These cranes are for handling complete locomotives, the lifting being done by hydraulic cylinders, the pumps of which are driven by an electric motor mounted on the crab of the crane.

The author expresses himself in favour of electricity for plant to which rotary engines are applicable, and states that for working with variable loads the advantage is decidedly with the electric appliances; views which we can welcome for their strict orthodoxy.

With regard to the distribution of power, the author gives the advantage to electric cables, pointing out that they are less costly than hydraulic pipes for conveying the same amount of energy, and when worn have a larger proportion of scrap value. Further, electric cables are more easily laid, adapt themselves more readily to inequalities and settling of the ground, are not liable to complete fracture and consequent stoppage of work, and are unaffected by frost.

In conclusion, the tendency towards the use of electric appliances, referred to in a note on this subject at the last Conference, is decidedly on the increase, and the advantages are such as to indicate further development with increased experience.

Discussion.

Mr. E. B. Ellington, comparing hydraulic and electric cranes, said that the latter would use power more or less in proportion to the load, but generally his experience showed that at full load the former was more economical. A long series of experiments had shown very little difference, but the demand on the central station was greater with electric than with hydraulic cranes. He considered that at high load factors the cost of energy under either system was practically the same owing to the advantages of the accumulators used in the hydraulic system, but that, at low load factors—which must necessarily occur—the hydraulic central station had a considerable advantage, because the reduction of the load factor did not reduce the efficiency to the same extent as would be the case with electrical plant, whilst there was a reduction in coal consumption. The question of lighting he considered very important. Dock lighting was largely continuous and would tend to improve the load factor, as had been shown by actual trial.

Mr. A. G. Lyster said that a ship's cargo must be handled where she berthed, and it was therefore economical to bring the cranes to the ship. In his opinion electrical equipment could not perform all the operations necessary for dock machinery, which would seem to point to a combination of the electric and hydraulic systems; though, on the other hand, hydraulic power was capable of performing all the requisite work. He did not say the latter was so economical, as, with rotary machinery and varying loads, electricity had advantages, but the hydraulic plant was simple, requiring very little attention and care, and it could perform economically all the operations required. It seemed to him that the effect of setting up electric plant where hydraulic power was in use, would be that the two systems would spoil each other's economy by reducing each other's load factor. He referred to the gas engine as being probably more economical for graving dock work, &c., than motor driving, taking the ordinary load factors of electrical systems in docks.

Dr. Corthell said his own experience in South America and the United States led him to believe that electricity would in future be much more largely used in dock work. At Buenos Ayres, Rosario, and Rio Grande, electricity had been adopted for all uses. In the United States a large canal was being built; a 12-ft. canal for barging; one lock would have a 43-ft. lift. The gate would be 53 ft. high with a 45-ft. opening. There would be 70 movable bridges. All gates, sluices, valves, in fact, every bit of machinery from end to end was to be operated by electricity, and five or six years hence some interesting figures should be available. Generally, he thought that the balance was in favour of electricity, which better met the general demand for power than did the hydraulic systems.

Mr. W. Pitt expressed surprise at the enormous development which had taken place in the use of electricity in the past three years. A good hydraulic crane, properly designed and working at full load, was a

good and economical machine, but as to new apparatus he distinctly held that engineers would be wise to adopt electricity. There were so many things now to do in a dock that it was almost becoming a manufacturing place. Electric driving had become the recognised method in the machine-shops, and he thought that was really what had turned the scale. Electricity was not only flexible in respect of its transmission, but it was flexible in division; that is to say, not only as to distribution of power to a crane, but *about* a crane. In nearly all new apparatus electricity was being adopted, and it had all turned on that one point of flexibility.

Mr. W. H. Hunter said that he had had both hydraulic and electric systems working side by side in the Manchester Ship Canal Docks, and very nearly in equal proportions. They had something over 70 hydraulic and very nearly 70 electric cranes. The hydraulic cranes had been in operation the longest, but some years ago the hydraulic plant was being worked to its full capacity, and it became a question whether he should advise the extension of the hydraulic plant or, having a free field so to speak, whether he should recommend an electric system. Looking at the matter all round, and taking into consideration that the extension included a large grain elevator which could be worked economically by electricity and not possibly by hydraulic power, so that the adoption of the latter would have necessitated a separate arrangement being made for the grain elevator, they decided upon electric power. On looking back at all that had happened since then, he said most unhesitatingly that, if called upon again to make a similar decision, he could not admit that the question (except for one small item of machinery) remained a matter for discussion. Electricity was so much more convenient, so much more flexible, and so much more adaptable to requirements, that he could not see any reason to hesitate now. He added that their hydraulic plant—installed years ago by Armstrongs—continued, and economically, to work their gates, and that personally, he thought hydraulic power the most suitable and the most economical for that kind of work and (owing to the difficulty of insulation and other matters) the hauling capstans. He had tried to get reliable figures of relative cost of the two systems for some years past. The costs of maintaining hydraulic and electric cranes were about the same per annum. Some time ago they were able to take a parcel of cotton, and work one portion by hydraulic and the other by electric crane. In each case the lot was about 100 tons, and the cost of working, computed by different people, was almost identical. In the case of electric it was 13·82d., and in the case of hydraulic 13·56d. This, however, did not represent the average results, as the character of the work was such that it did not allow for the flexibility of the one power as against the inflexibility of the other. Whilst the maintenance of the electric crane was less than the hydraulic, the first cost of electric plant was considerably higher than that of a hydraulic installation. Putting it altogether, there was something like equality between the two systems, but so far as convenience of working was concerned there was a decided balance in favour of electricity. Electricity, too, was quieter; this might seem a small thing, but it helped in working, as the men in the hold of a vessel could hear instructions better, and all these little things counted.

Mr. C. A. Brereton said that in handling heavy weights reliability was a greater consideration than cost. In certain cases—such as the controlling of dock gates, &c.—failure might be disastrous. For this kind of work and for such as they had in South Wales with the coal (such as Penarth, where they handled 10 or 12 million tons per annum), he thought hydraulic machines had proved superior, and the cost worked out very small indeed, though, of course, the relative size of the two installations must be taken into account in comparing the cost of the two systems. There was, however, no question that for light work, such as driving grain elevators, conveyors, machines, &c., electricity was most suitable, and so most docks were found to have the two systems. At Avonmouth this plan had been adopted, the gates, sluices, capstans, &c., being worked hydraulically, and the cranes, elevators, conveyors, machines, &c., electrically. The electricity was obtained from the town supply, and he thought that it would have cost more if the docks had put down their own plant.

Mr. S. Humphrey emphasised the fact that many docks required power for handling coal in large parcels, with a constant load at slow speed, and that for such purpose hydraulic power was most suitable. The use of hydraulic power was developing in America. An electric generating plant was capable of a considerable overload. A point which did not appear to have been touched upon was the life of the plant. The period within which the capital expenditure had to be made good was a most important matter.

Mr. C. S. Meik said that at Middlesbrough Dock, trials were made in 1903 by Mr. V. Raven, which gave the following results:—Electric power, 2·02d. per unit; hydraulic, 12·82d. per 1,000 gallons, or equivalent to 2d. per unit. The results of trials made the same year at Glasgow were:—Electric power, 2·552d. per unit; and hydraulic power 17·67d. per 1,000 gallons, or equivalent to 2·71d. per unit. At Leith the cost of electric power was about 1·50d. Returns from Swansea for the whole of 1906 gave the cost of hydraulic power as 8·41d. per 1,000 gallons, equivalent to 1·29d. per unit, or less than half the cost at Glasgow in 1903. The cost to the borough of electric power in Swansea at that time was 1·27d., but the cost of such power to the docks was 1·29d., or the same as hydraulic power. In making these comparisons, 1,000 gallons at high pressure was taken as equal to 6½ units. Other places could be cited where electrical energy cost less—Newcastle, for instance, where the price was ·67d. That figure, however, did not include interest and depreciation; and the Swansea prices, taken on the same footing, would read ·91d. in 1906, and (for a period of nine months only) ·79d. in 1905.

Mr. G. H. Abernethy said that docks varied so much in their trade that the special requirements of each case must be considered before any recommendation could be made. In the cases of dock gates, the employment of hydraulic machinery was almost a necessity for convenience and safety. For lighter work electricity was preferable, and it was important to be able to obtain a local supply, so as to avoid capital outlay on plant.

Mr. W. Stoker pointed out that the power of the hydraulic accumulator was only momentary, whilst the overload capacity of the electric plant was something which continued for a length of time. He thought Mr. Hunter must have been very unfortunate with his electric capstans; perhaps he had been compelled to accept the lowest tender, a curse which followed all electrical machinery, and which he would like to see mitigated if possible.

Mr. C. E. Vernon emphasised Mr. Stoker's remarks as to the length of time for which the overload capacity of electric plant was available as compared with that of the hydraulic accumulator. At the London Docks they found it necessary to use both powers (the hydraulic for gates, &c.), and they also had to supply electricity to customers. At the Tilbury Docks they had both plants in all rooms, and the same stokers stoked all the boilers, and the same engineer looked after plant. Their electric current cost them 1d., and hydraulic power 6d. per 1,000 gals.

Mr. T. J. Robson said that from recent inquiries he estimated the first cost of a suitable crane with a 65 ft. radius at £1,000 for hydraulic, and £1,350 for electric. As to maintenance, in the case of the hydraulic there should be no difficulty in getting this done for £5 per annum, but with the electric machine, after three or four years, it would probably be from £20 to £30. As to comparative working cost from reliable figures, he put this at 1·5d. per ton for hydraulic, and 2·5d. per ton for electric. In each case the machines were handling heavy cargo at maximum load. In the case of general cargo from ships, he put the hydraulic costs at 3d. If the gas engine could be applied to plants of any size, he thought it would result in bringing the cost down to 3d. per 1,000 gallons.

Sir William Matthews briefly summed up the discussion as being, in effect, a declaration in favour of hydraulic power for the heavy work, and of electric power for the lighter and more general work.

(To be continued.)

INTERNATIONAL EXHIBITION (DUBLIN).

Second Notice.

While the Exhibition is primarily of a general nature, there are a few stands in the Machinery Hall which have a particular interest for the electrical engineer; and those manufacturers who were courageous enough to cross the Channel ought to have their just reward. From what we hear, it is probable that they will not regret putting their money on an outsider, as Ireland south of Belfast is reckoned in the Engineering Stakes.

First, of engineering exhibitors, in order of precedence as a purely Irish firm come Messrs. Wm. Coates & Son, Ltd., of Belfast and Dublin. The main switchboard and the space below it constitute their stand, but their exhibit is confined only by the boundaries of the Exhibition itself, as they were responsible for everything electrical throughout the grounds and buildings.

It is worth remarking that the catering and the buildings were given to English firms, but that it was not necessary to go out of Ireland in placing the other large contract. Messrs. Wm. Coates and Son also laid the three miles of fire mains, with 70 hydrants, Messrs. Glenfield & Kennedy, of Kilmarnock, supplying the material.

The British Westinghouse Co., show an interesting and varied lot of their smaller goods. Switchgear is represented by a three-phase auto-starter, D.C. and A.C. circuit-breakers, crane and tramway controllers. Three sizes of the Cooper-Hewitt mercury vapour lamp are shown with great effect, taking the eye of the visitor at once with the unusual colour of their light.

The first Osmin lamps in Ireland are to be seen burning on the Westinghouse stand, outvieing even the Tantalum in efficiency; while the carbon filament lamp, not yet deposed, reaches high efficiency under the Westinghouse patents and burns in company with the Osmin, safe in the knowledge that its type is going to be indispensable for a long time to come. Continuous-current and three-phase motors make this stand complete.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., repeat the captivating display which they made at Olympia, young men and maidens, old men and children, stopping to gaze with wonder at the bristling or gracefully drooping ends of the multicore telephone cables, and at the central erection of drums, which is neither a pyramid nor a cone but might be called either without greatly offending the pedant. The drums contain cable ranging from the heaviest armoured type to the humbler 7/18, with coils of flex sitting lightly on the top. Of the accessories which Messrs. Henley make, the most noticeable are the neat ironclad house service fuse box and the tramway feeder pillar.

The India Rubber, Gutta-Percha and Telegraph Works Co., Ltd., show a great variety of rubber and vulcanite goods, such as motor-car tires, waterproof garments, acid jugs and the like. The visitor would not realise that the firm is noted for cables, for their acquaintance with electrical work is signified chiefly by a low resistance heavy current primary battery, and by instruments of

different kinds. Their latest form of electrical water-level indicator is on view. If we may venture to criticise and to compare, we would say that the "open-air system" adopted by Henley's is far better for exhibition purposes than that favoured by the I.R. & G.P. Co., which consists in cramming too many things into a regular room with opaque roof and one side only half glazed. The only advantages of such an unattractive method, are that less dusting is required, and the exhibit is more easily protected at night, but the objectionable features are much more important.

Messrs. R. Waygood & Co. have done so much business in Ireland, that it is natural enough to find them holding a stand. The finely-finished working model of their automatic push-button lift, which visitors to this year's Building Trades Exhibition at Olympia will remember, has been sent to Dublin, and the printed request to push the button draws few refusals. This lift is driven by an electric motor, and controlled in a simple and beautiful manner by auxiliary electric circuits derived from the main supply.

Powerful solenoids make the necessary circuit combinations for movements of the cage either in the up or down direction, and cut out at a safe rate the starting resistance of the motor. The collapsible gate at each floor is locked mechanically and electrically, except when the cage is standing exactly opposite some particular door, that alone being openable; and, so long as any gate remains open, the control circuit is broken at the lock, and the cage cannot be moved in either direction.

Once inside the cage, with the gate closed, the passenger can travel to any floor by pressing, for a moment, the appropriate button.

One of these push-button lifts in Dublin is fitted with an auxiliary levelling button, by which the cage floor can be brought into exact line with the landing, so that a patient lying at full length on a special trolley can be wheeled in and out without the least shock.

Messrs. E. Green & Son show a large model of the latest pattern of their economiser, without the clouds of dense black smoke issuing from the stack which mar their well-known advertisement. Filling the centre of the stand is a full-sized flue-gas air-heater, with the front wall removed; the general design of which is similar to that of the economiser, the only differences being that air is driven through the tubes instead of water, and that a lower temperature is required.

A double-acting Cameron pump is supplied with steam from the main boilers, and part of the top header of an economiser is shown in which the patent internal "master lid," and seating are turned and bored *oval* so perfectly that the metal-to-metal joint holds tight under pressure as successfully as the round lid. At the date of our inspection of this stand, Messrs. Green had in hand at Wakefield orders for economisers amounting to 80,000 pipes 9 ft. long by 4½ in. diameter, the capacity of the works being approximately 5,000 such pipes per week.

The 180-B.H.P. gas engine by Crossley Bros., which was mentioned in our previous notice as being a very serviceable unit of the power-house plant is started by compressed air obtained from a 1·2 B.H.P. gas engine and pump which delivers air at 70 lb. pressure. This air is used also for blowing through the oil passages in the bearings of the large engines in the power house.

In Crossley's stand are to be seen also a 3½-H.P. portable petrol engine useful for farm work; a No. 2 suction-gas plant with the new single combined scrubber in which the sawdust is put on the top and coke at the bottom of a cylindrical tank; and a 16-H.P. gas-engine coupled direct to a dynamo by the Lancashire Dynamo and Motor Co. Two 4-H.P. Crossley engines are used to drive the compressors for the high-pressure system of gas lighting which uglifies part of the grounds. Mr. C. F. Crabtree, the Dublin representative, is in charge of the stand.

The National Gas-Engine Co. have an equally good show, the main effect being produced by a row of gas engines set on the skew and diminishing regularly from 28 B.H.P. to 6 B.H.P. They are all running off two suction-gas generators, exactly similar to the type which secured the gold medal at the Derby trials.

A neat little vertical gas-engine of 8 B.H.P. with dynamo on the same shaft is intended for country-house lighting, and a National petrol engine air compressor combines the purpose of show with that of starting the 400-H.P. engine described in the first article. Mr. Carter, the Irish manager, is responsible for the exhibit.

Messrs. Babcock & Willcox, not content with the fine display of their boilers which supply the power station with steam, have a stand at which the silent gravity bucket conveyor, so familiar to engineers, is shown at work. Dublin already knows something about the sterling qualities of this conveyor, for there is a large installation at the Ringsend Power Station of the D.U.T. Co., and Messrs. Guinness have just put one in at the brewery. The latest improvement is in the design of the automatic filler which allows enough and no more to drop into each bucket as it passes, and prevents spilling.

The executive charge to stallholders is 30s. per 16-C.P. lamp for the period of the Exhibition, including in that figure, wiring, simple brass fittings, lamps, and light. Where motors or a great number of lamps are used the energy is metered, and charged for at the rate of 2½d. per unit. These charges are almost too reasonable for an exhibition, but there is no doubt that from the point of view of the electrical profession and trade the effect will be excellent. Many large exhibitors now make their first personal acquaintance with electric motors and realise, as they never would by hearsay only, how adaptable, how simple, how economical the electric drive is, and hope to introduce it in their works later.

All the meters have been supplied by the Reason Manufacturing Co., and are of their standard displacement type, in sizes up to 250 amperes. These meters fulfil admirably the requirements of an exhibition, being so easily erected and highly accurate, but at the same time able to protect themselves against a good deal of rough usage.

The Robertson Lamp Works attract crowds to their stand, just as they always do. The way in which the lamps have stood the climatic conditions of last winter and spring up on the Dome is sufficiently good testimony to their mechanical excellence at least.

Messrs. W. H. Allen, Son & Co., Ltd., of Bedford, have a large staff of men permanently employed in Ireland, as they do a great deal of work, including electric lighting, for Harland & Wolff, and other shipbuilders and engineers. They show, in the compact and solid design which proves long acquaintance with the confined space of a ship's engine room, two high-speed enclosed engines, one of 450 H.P. with three cranks, one high and two L.P. cylinders; the other, indicating 220 H.P., being a two-crank compound with only one eccentric for both piston valves. These valves are in distinct chambers, and the design combines the compactness of the vertical type with the advantages of separately cast cylinders. The alternative method adopted by some other makers in order to use one eccentric is to place the valves in tandem. In addition to the steam engines, Messrs. Allen have an Edwards three-plunger air-pump with a capacity of 30,000 lb. per hour, driven by a 30-H.P. single-cylinder steam engine; and multi-stage Conqueror high-lift turbine pumps of various capacities.

Although the analogy is as imperfect as most, the "Singleite" electric sign and the Geipel steam trap have much the same working principle. This novel flash sign consists of an 8-C.P. lamp sitting under a conical reflector in the middle of a ring of gilded letters like a spider at the centre of her web. The flasher which controls the lamp is a tiny article which can be placed in any convenient position. It is composed of two contact strips, on one of which is wound a small heating coil, which pulls the contacts apart after current has passed for a second or two. The circuit being broken, the moving contact contracts and re-makes the circuit. Simplicity can be carried no further. By the expedient of mounting the sign on a concave backing of dark cloth, the sign shows up brilliantly by day, or when the Machinery Hall is blazing with arc lamps.

The D.P. Battery Co. show a selection of cells for various duties, but the stand is small, in a bad position, and unattended. The man who can make an exhibition of accumulators interesting enough to attract the general public is not yet born, but there are several ways of trying. Nevertheless, the D.P. is the only battery represented, and we hope the company will reap the fruits of its enterprise. There is a growing field for accumulators in Ireland, owing to the large number of private house and public institution installations which are being put down more frequently every year. The tantalum lamp is used by exhibitors largely, and Messrs. Siemens Bros. have their comparison board on Messrs. Coates and Son's stand, with banks of carbon filament and tantalum lamps connected each to their own ammeters with scales reading in pence per hour.

Messrs. Musgrave & Co., of Belfast, who supplied the induced draught fans for the boilers, have others on their stand coupled to Crompton motors.

Messrs. Ross & Walpole, of Dublin, show a marine boiler built for Guinness, screw couplings, railway chairs forged in a hydraulic press, and a large steel tip-waggon for malt. The various steamship and railway companies of Great Britain have sent as complete a collection of models as we have seen. Attracting much popular attention, and aiding substantially a local charity, is the L. & N.W.R. model of the Royal saloon, which gained the Grand Prize at the St. Louis Exhibition. The interior is lit electrically by a little motor-generator started by a penny-in-the-slot mechanism. The actual Royal Saloon built by the Midland Great Western of Ireland, and a magnificent engine and tender of the Great Southern and Western Railway Co., stand on specimens of the permanent way of each system.

The Dublin United Tramways Co., who are among the largest guarantors of the Exhibition, have lent a new car. It is a large double bogie, double-decker, built at their own works at Inchicore, and is as fine a specimen of car building and painting as can be seen anywhere in Great Britain. Except that there is no top deck cover, it represents the latest standard of the company. The overall length is 34 ft., the greatest width (over driving-axle boxes) is 7 ft. 1 in, and the seating capacity is 31 inside and 45 outside, the odd number inside being made up by a sort of music-stool seat at the front end. The platforms are vestibuled, and in view of the controversies which have arisen on several occasions, it is interesting to hear that vestibules have been used for many years on a proportion of the Dublin cars, and are liked so much by the men and the management that they have been incorporated in the standard design. As these vestibuled cars have been used chiefly on the lines which run around the bay, and are the most exposed to bad weather, the objections which have been raised elsewhere do not seem to have troubled Dublin; and although the speeds are high at all times, and the mileage great, the casualty list compares well with the average.

The exhibition car is carried on Mountain & Gibson No. 3 L maximum-traction trucks of the latest L.C.C. pattern. The wheels are steel tired, and the British Westinghouse electromagnetic wheel and track brake is fitted to both trucks. These brakes are used for service stops, and the average speed has been increased thereby. The controllers are British Westinghouse T. 1 C, recently described in these columns, and the motors, by the same makers, are of their W 220 pattern, each 40 H.P. This car stands on the D.U.T. standard permanent way, the rails being No. 4 British standard, weighing 105 lb. per yard, and rolled in 45-ft. lengths. Four cross anchors of old rail inverted are bolted to each length, and the joints are made with 36-in. fish-plates, and have sole-plates of old rail beneath them.

As a contrast to the modern railway rolling stock, a few relics have been brought in, the most interesting being a second-class open-sided coach built in 1837 for the service between Dublin and Kingstown. It stands on a portion of the old permanent way laid in 1833, consisting of iron rails weighing 40 lb. per yard, laid on cast-iron chairs fastened to granite blocks.

The Castlecomer Collieries, Co. Kilkenny, show a large working model of the complete overground and pit-head workings of their anthracite collieries, including a four-grade washing and screening plant.

The Wexford Engineering Co. is the first Irish firm to make a suction gas plant. A large one is on view at their stand.

Mr. F. Nell has supplied two three-throw pumps, which are connected into the fire mains, and draw from the artificial lake. They throw a column of water 150 ft. high, so that they are valuable auxiliaries to the Pembroke and Dublin water supplies, to which the mains are connected also, and they will be used for fire brigade displays.

Messrs. Gwynne's, Ltd., have supplied one 8-in. and one 9-in. centrifugal pump, which together deliver 2,500 gals. per minute against a total head of 10 ft. for the "Rivers of Ireland." These pumps are driven by 10-h.p. Westinghouse motors.

The Exhibition cannot fail to be of great educational value to Ireland, and we wish the Executive better weather and bumper attendances. Croakers were heard to declare on the opening day, which, by the way, was fine, that the guarantors would never see their money back; but with good management and a reasonable amount of sunshine both ends will meet and might overlap.

THE RADIO-TELEGRAPHIC CONVENTION.

[The Report of the Select Committee of the House of Commons.]

On Friday, March 8th, 1907, it was ordered that a Select Committee be appointed to consider the Radio-telegraphic Convention signed at Berlin on November 3rd, 1906, and to report what, from the point of view of national and public interests, would, in their opinion, be the effect of the adhesion or non-adhesion of this country to the Convention. The Committee was nominated as follows:—Mr. Adkins, Mr. Sydney Buxton, Sir John Dickson-Poynder, Mr. Enoch Edwards, Mr. Gwynn, Sir William Holland, Mr. Lambert, Mr. Arthur Lee, Mr. Macpherson, Sir Gilbert Parker, and Sir Edward Sassoon, and were given power to send for persons, papers and records.

The proceedings of the Committee have been public, and every opportunity has been afforded for evidence being given germane to the inquiry.

Thirteen meetings were held, and 18 witnesses, whose official or commercial experience and scientific attainments qualified them to give evidence, were examined; among them being several of the British delegates at the two Berlin Radio-telegraphic Conferences of 1903 and 1906, Government representatives of the Admiralty, War Office, Post Office, and Colonial Office; a representative of Lloyd's, and one from a steamship company representing shipping interests; scientific and other witnesses to explain various systems; Mr. Marconi and representatives of the Marconi Companies.

The Committee was furnished by several witnesses with a general review of the past history and development of the art of radio-telegraphy dealing with the early conduction system, the electro-magnetic system, and the many variations of the Hertzian system.

It was stated that signals had been transmitted across the Atlantic, but that the communication had not been effectively maintained with regularity, especially by day. The maximum effective range for regular communication by day or night was estimated to be from 1,000 to 1,500 miles, for large powerful stations. For ordinary ship and shore communication 300 miles is about the longest effective range.

The Admiralty are able, under certain conditions, to determine the direction from which radio-telegraphic signals are coming; and attempts have been made to direct the outgoing waves, but only with moderate success.

It appears to be generally admitted that Hertzian waves were first experimentally applied for practical telegraphic purposes in 1895-6 by Mr. Marconi. The principal systems in use are:—Marconi, De Forest, Fessenden, Lodge-Muirhead, Telefunken, Rochfort, Branly-Popp, Poulsen, Shoemaker, Massie.

According to the most recent statistics, there are 186 commercial radio-telegraph stations throughout the world, 63 being Marconi, and 123 stations with other systems.

The use of radio-telegraphy for commercial and mercantile purposes may be classed as follows:—

(*a*) Shore to shore communication.
(*b*) Ship to ship communication.
(*c*) Ship and shore communication.

A shore station is intended to indicate a fixed station, either on the coast, inland, or on a fixed ship such as a lightship, so that a shore to shore communication need not necessarily be over sea, but may be entirely inland such as Berlin to Paris.

It is due to the rapid extension of ship and shore communication that has rendered International regulation necessary.

The progress of radio-telegraphy has been carefully watched by the British Government from the time Mr. Marconi first made his experiments in England in 1896-7 in co-operation and with the assistance of the British Post Office.

The Admiralty obtained sets of apparatus in 1899, and in 1901 made an agreement of a limited character with the Marconi Co. In July, 1903, a further and more complete agreement was entered into by the Admiralty covering a period of 11 years expiring in 1914. This agreement grants the Admiralty the full use of the Marconi patents then existing and future, and to the exclusive use of a long-distance station for 20 minutes every day, to priority over all other messages to the supply of all apparatus at current prices and to information concerning any improvement in apparatus or in methods of signalling. In consideration for this the Admiralty paid the company £20,000 with £1,600 royalty for 32 existing installations and £5,000 a year for the duration of the agreement.

Lloyd's in September, 1901, entered into an agreement expiring in 1915 with the Marconi International Marine Communication Co. (an offshoot of the Marconi Wireless Telegraph Co.) under which Lloyd's have the right to use Marconi apparatus at all their stations and engage to use no other, and also not to communicate with ships using any other system or to permit the use of any other system at or in connection with their signal stations. The agreement is of importance, because of the restrictions it imposes on Lloyd's, against employing or communicating with any other system than the Marconi system. An instance was given when the general public interests were endangered, and human life jeopardised owing to the refusal of the Marconi Co. to allow intercommunication. In 1906 the United States steamer *Lebanon* was engaged to destroy a derelict said to be endangering vessels crossing the North Atlantic. While searching for the derelict, the *Lebanon* got into wireless communication with the Marconi-equipped Red Star steamer *Vaderland*, in the hope of getting information. The *Vaderland*, however, declined to communicate. Lloyd's have also been unable to establish wireless stations at various British Colonies, because the Colonial Governments make intercommunication a condition if required by an International Convention.

By the year 1903 it was evident that International agreement would soon be urgently required. A conference met at Berlin in August of that year, and with the exception of Great Britain and Italy, all the great Powers agreed to certain proposals to be considered at a subsequent conference for the International regulation of wireless telegraphy, including the obligatory exchange of messages between different systems.

The second conference was summoned for the Autumn of 1906, and instructions were given to the British delegates—"That the principle of compulsory intercommunication should be accepted provided that such regulations should be drawn up, together with provision for their enforcement, as would, in the opinion of the Admiralty, be adequate for the purpose of effective control over the general transmission of messages to or from stations in British territory and of preventing interference and confusion; but that discretion should be reserved to the Government to exempt particular coast stations from the obligation to intercommunicate.

The Convention was signed at Berlin by Great Britain on November 3rd, 1906.

The object of the Convention is to facilitate ship-and-shore communication, and its main provisions may be classified under the following heads:—

1. The acceptance and transmission of telegrams.
2. The adoption of uniform rules of working.
3. The provision of means of collecting charges and settling accounts between the different countries.
4. Arrangements for the publication of all information necessary for intercommunication.
5. Rules to prevent interference and confusion in working, with adequate provisions for their enforcement.
6. Provision that, with certain exceptions, intercommunication must not be refused on account of differences in the systems of wireless telegraphy employed.

A proposal was brought forward by the representatives of the United States to extend the scope of the Convention so as to include "ship-to-ship communication," but was opposed by the British delegation.

The rules of working laid down coincide, so far as circumstances permit, with those of the Telegraph Convention, in order to avoid confusion.

The regulations regarding charges and accounts are comprised in Article X of the Convention and Articles XII, XIII, XIV, XXXV and XXXVI of the Regulations. The principal object secured is that the whole charge should, in all cases, be collected from the sender.

A list of particulars regarding each station, such as name, nationality, geographical position, call signal, normal range, wave length, nature of service (public, private, &c.), will be prepared and circulated by the International Telegraph Bureau at Berne.

Special regulations in addition to the ordinary telegraph regulations were required to meet the peculiar requirements of radio-telegraphy to prevent interference.

(*a*) All stations are bound to exchange traffic with the minimum expenditure of energy required for obtaining effective communication.

(*b*) Uniformity in methods of working traffic and use of International code.

(*c*) Every ship and shore station must be licensed by the Government to whose authority the station is subject, and no ship station shall be licensed unless the system used is a syntonised one, capable of working at at least 12 words a minute, and not using an excessive amount of power. Every telegraphist must be licensed by the Government concerned, must have a competent knowledge of the adjustment of the apparatus, must be able to work at 20 words a minute as a minimum, and must know the regulations.

In addition, the certificate must testify that the particular Government has bound the telegraphist to an obligation of preserving the secrecy of correspondence.

(*d*) A breach of the Convention or regulations committed at a station is after inquiry, to be met by disciplinary measures by the responsibl,e Government, and, if need be, the certificate of the operator or ship must be withdrawn.

(*e*) Wave-lengths of 300 and 600 metres are specified for general public correspondence, so that with efficient apparatus two stations within range of each other can work without interfering.

For ships, the normal wave-length is 300 metres. Wave-lengths between 600 and 1,600 metres are reserved for Government purposes.

(*f*) Besides the above special regulations, Article 8 of the Convention requires that the working of all radio-telegraph stations shall be organised as far as possible, so as not to interfere with other stations. This applies to all stations without exception, and not merely to the commercial stations to which the Convention as a whole implies.

Ratification—For and Against.—Witnesses representing systems other than the Marconi were strongly in favour of the ratification of the Convention on the two-fold ground that their systems which they claim to be more perfect than the Marconi are greatly hampered; whereas under the Convention the free competition would ensure full opportunity for the development of improved systems.

The Marconi Co. raised the objection that International control would be a loose, dilatory, and cumbrous system. This, however, was fully met by the fact that although the complaints might be international, the control was national; therefore no unreasonable delay was anticipated. Further, continued breaches of the regulations by the same ship can be met by refusal to communicate under Article VII of the Regulations. The possibility of trouble from a particular ship exists at present without a remedy, whereas the convention would compel the responsible Government to withhold a license.

Mr. Marconi and the Marconi Co. raised the contention that whereas the Convention specifies wave lengths, other essential factors, viz., "amplitude" and "damping" had been ignored, therefore the treatment of the matter had been incomplete and unscientific. The Committee examined very closely into this complaint, and witnessed a demonstration at the Post Office.

Amplitude represents the vertical height of the wave, or the potential to which the wave-peak reaches at each oscillation.

Damping represents the dying away of the wave-train. A highly-damped train is one in which the train dies away in two or three oscillations (which has a rapidly diminishing amplitude—Eds. E.R.). A feebly-damped wave-train is one that persists for 10 to 20 oscillations. An undamped or continuous wave-train is one that persists and maintains a more or less continuous series of uniform oscillations.

The highly-damped wave is practically prohibited between ship and shore by the Convention, while the amplitude is met by limiting the power to be used to the minimum necessary to establish communication (Article 38). Under normal conditions this must not exceed 1 kw., unless the ship finds it necessary to exchange messages at a distance of more than 300 km. from the nearest coast station, or if by reason of intervening obstacles communication can only be effected by an increase of power.

The Conference refrained from dealing further with these questions, as they considered that it would have been injudicious to impose restrictions at this early stage which might have impeded the progress of the science, and given the Marconi Co. more legitimate reason for complaint.

The Marconi Co. also complained of the appropriation by the Navy of the 600 to 1,600 metre wave-lengths, and to the restriction of the commercial wave-lengths to 300 and 600 metres.

Even if the complaint against the Navy were well founded, a commercial company must be subordinate to the highest national interests. Further, each Government may authorise the use at any coast station of other wave-lengths for the purpose of providing a long-distance service or a service other than that of general correspondence established in accordance with the provisions of the Convention on condition that these wave-lengths do not exceed 600 metres, or do exceed 1,600 metres.

The Committee desires to lay emphasis on the following position: Marconi witnesses were closely cross-examined on the alleged oversight in not including provisions regarding amplitude; and on it being shown that the provisions met every contingency, then raised the objection that these provisions would not be effective, and that Governments generally would not feel inclined to encourage improvements. That is to say, the Governments having internationally recognised the existing systems, which admit of intercommunication, would discourage new and improved systems which would not at the outset intercommunicate.

The Convention deals with things as they are, and regulates radio-telegraphy as it stands. It leaves the door open for improvements, and there is no reason for assuming that any Government would willingly embarrass science by artificial obstacles.

The question of intercommunication arising out of the policy of the Marconi Co. proved to be in many respects the most important arising under the convention. The reason why the Marconi Co. were against intercommunication was stated to be that by unity of control it was hoped to secure more effectually the observance of their rules and the avoidance of confusion and interference, but other evidence was given expressing the opinion that it was with a view to create a monopoly for the Marconi Co., since being in possession of shore stations at many of the most important points of the coast, they hoped to compel ships to adopt the Marconi system to communicate with those stations and other shore stations to do the same in order to communicate with the ships.

Although it was generally admitted that all "Spark" systems intercommunicate readily, some considerable doubt was expressed in regard to the present possibility of commanding intercommunication between the arc and the spark systems. The introduction of new systems unable to intercommunicate is, however, provided for under Article 3 of the Convention provided the incapacity is not due to arrangements adopted solely with a view to prevent intercommunication.

Imperial Interests.—The colonial interests have been safeguarded by the reservation of freedom of action quite independent of the mother country or any other colony.

The maximum number of votes per country is six, and the colonial votes will be allotted at the next conference which will meet in London in 1911.

Naval Interests.—Naval and military stations are placed outside the Convention except in respect of the general obligation to avoid interference as far as possible, and with regard to ships in distress. Processes of secret working need not be divulged, and supplementary secret apparatus may be set up at stations open for public correspondence.

Great importance is attached to the reservation that certain stations may be exempted from intercommunication as this will provide greater flexibility and provide for unforeseen developments.

By ratification of the Convention many great advantages will be gained from a naval and military point of view, without any disadvantages; whilst a non-ratification will bring many corresponding disadvantages with no benefits.

Commercial Interests.—It is obvious that general intercommunication is absolutely necessary in commercial interests, and as this can only be effectually obtained by International agreement, there is every reason on this ground for the ratification of the Convention.

Position of the Marconi Co.—The Marconi Co., the only opponents to the Convention who have appeared before the Committee, cannot be regarded as having any claim to a monopoly of radio-telegraphy, although under present conditions they have secured what amounts to something approaching a monopoly in respect of Great Britain, Italy and Canada.

The agreement of 1904 between the Postmaster-General and the Marconi Co. contained the following:—"In the event of His Majesty's Government adhering for the United Kingdom to a Convention based substantially on the stipulations contained in the Protocol of the recent Berlin Conference on Wireless Telegraphy, the companies undertake, if required by the Government, to observe in the United Kingdom and on British ships the provisions (except Article 6) of the Convention and of any detailed regulations made thereunder for carrying these provisions into effect, and in particular and without prejudice to the generality of the foregoing undertaking, the companies undertake, if required by the Government in relation to shore stations in the United Kingdom, and ships equipped with Marconi apparatus for ship and shore messages, to accept (without prejudice to the patent rights) the obligation to interchange messages with ships and shore stations in the United Kingdom respectively equipped with other apparatus, and to relieve the Admiralty and Lloyd's, and all other persons with whom the companies have contracted from any obligation arising under their contracts to refuse to interchange messages with ship or shore stations in the United Kingdom so equipped, or to make any compensation in respect of the interchange of such messages."

The Marconi Co. propose to make use of the words "without prejudice to their patent rights" in order to evade the obligation to intercommunicate. Their contention may, or may not, be found sound in a Court of Law, but it appears obviously inconsistent with the intention of the parties when making the agreement. If this intention was in the minds of the Marconi Co. when they negotiated the agreement, it would appear to be open to grave criticism in that they are now endeavouring to evade the main condition which led the Postmaster-General to enter into an agreement granting them advantages which they have enjoyed, still enjoy, and propose to retain. The ratification of the Convention is more likely to lead to the increased use of Marconi apparatus by ships which at present will use none on account of the want of intercommunication facilities.

The present advantageous position of the company's stations would naturally give them a greater volume of business. Also, the company will receive an additional rate per message interchanged with other systems until 1911.

In reviewing the relations of the Government with the company, two points stand out especially clear in the light of subsequent events.

1. If, at the time when the Post Office were giving to Mr. Marconi effective assistance, the Government had thought it expedient to secure the right of pre-emption of his invention and patents, an enterprise of national importance would have been prevented from passing into the hands of a private company, and subsequent difficulties might have been avoided.

2. The fact, to which reference has already been made, that the Post Office has largely refrained from issuing licenses to other companies, has given the Marconi Co. something approaching a monopoly during an important period, and may therefore have encouraged their dreams of a general monopoly.

General Observations.—The Committee concludes with the opinion that there are three alternatives to Great Britain, viz., rejection, postponement or ratification.

Rejection.—The only evidence in favour of rejection was that of Mr. Cuthbert Hall, general manager of the Marconi Co.; of Prof. Fleming, scientific adviser of the Marconi Co.; of Mr. Henniker

Heaton, and, with much less intensity, of Mr. Marconi. Their evidence shows that their arguments were based mainly on a consideration of the interests of the company.

On the other hand, several injurious effects will no doubt arise if the Convention is rejected.

(*a*) Doubt would be thrown on the sincerity of Great Britain's expressed views at the Conference.

(*b*) It would create a direct and powerful motive for the erection of stations on foreign territory; and such stations will be in no way subject to British control in time of war or emergency.

(*c*) Foreign ships and coast stations would seriously interfere with British stations, and there would be no remedy even if the interference were intentional.

(*d*) In the absence of International arrangements and rules for working, the accounts, the collection of charges, and the development of the service would be seriously embarrassed.

(*e*) The drawbacks indicated in the three previous heads would be specially detrimental to Great Britain, owing to the predominance of her maritime interests and her geographical position.

(*f*) Under the terms of the Convention, the nations adhering are bound to refuse to license on board a ship or at shore stations the apparatus of any system which declines to accept the principle of intercommunication. If Great Britain, therefore, refuses to ratify, the Marconi apparatus at present installed at foreign shore or ship stations will be replaced by some system that accepts intercommunication.

Postponement.—No evidence was given to the Committee in favour of postponement as distinguished from non-ratification. It may be pointed out that postponement would in no way diminish the unfortunate results which would follow on rejection, and in addition the action of Great Britain would be open to much misconstruction in regard to the position she took up at the Conference. Further, it would prolong a period of uncertainty without securing any conditions by which the future would be determined. No evidence was brought before the Committee to show that within a specified time there would be any substantial alteration in the scientific aspects of the question. Moreover, the Convention would be brought into operation without reference to Great Britain.

Ratification.—The principle advantages attending the ratification are:—

1. Facilitates general working, control, &c.
2. Prevention of confusion and interference, which can only be done by International agreement.
3. Freedom of communication between ships, which is a more valuable advantage to Great Britain than to other countries.
4. Encouragement to the development of radio-telegraphy, by giving free play to all systems.
5. Important advantages to Naval interests and National defence, not otherwise obtainable, among which may be mentioned:—

(*a*) No interference.
(*b*) Reserved wave-lengths.
(*c*) International sanction obtained for such censorship arrangements as may be necessary.
(*d*) Extension of wireless telegraphy in the British mercantile marine, over which the Navy would have control in time of emergency.
(*e*) The interests of British colonies have been safeguarded.
(*f*) Great Britain can withdraw from the Convention by giving a year's notice, yet, if she ratifies, no alteration to her detriment can be made in the Convention without her consent.

Conclusion.—The Committee, therefore, report that in their opinion the effect of the adhesion of this country to the Convention would be advantageous to national and public interests, and that its non-adhesion would be detrimental to those interests.

Assuming that the Convention is ratified, it will come into operation on and from July 1st, 1908, and subject to the provision of withdrawal, will remain in force for an indefinite period.

[*Abstract of Memorandum to the Select Committee regarding Radio-telegraphy, by Mr. Chas. Bright, F.R.S.E., A.M.I.C.E., M.I.E.E.*]

Pioneering of Radio-telegraphy—In connection with the subject of monopoly, there is an idea held by many people that Mr. Marconi is the sole pioneer of wireless telegraphy, and that to allow competition would be unjust.

In 1863 Clerk Maxwell worked out mathematically the theory of electro-magnetic waves in the ether and their relationship with waves of light.

In 1888 Hertz (a distinguished German physicist) produced, demonstrated, and described them. Then Righi (a noted Swedish professor), who was Marconi's tutor, produced a radiator that was a development of the Hertz oscillator; while Branly (a leading French scientist) introduced the coherer, an instrument suitable for the reception of electric waves.

In 1894 Sir Oliver Lodge showed at the Royal Institution a complete set of Hertzian wave apparatus, and transmitted electrical signals from one room to another without intervening wires, using a somewhat improved Hertz radiator and a coherer which was an improvement upon Branly's.

In 1896 Mr. Marconi took out his first patent for commercial wireless telegraphy. His radiator was practically Righi's, and his coherer a decided improvement on Branly's. The main difference in his apparatus was the connection to "earth" and the employment of an aerial wire supported on a high mast. There is no mention of the elevated antenna in his patent; and the use of the earth had been previously adopted by both Dolbear and Popoff, besides being specified by Lodge in "Electric Radiation" in 1889 (*Philosophical Magazine*, July, 1889). Moreover, in 1894, at the Royal Institution lecture, as well as at the Oxford British Association meeting in the same year, Lodge described the effect of an antenna in collecting the waves and bringing them to the coherer. There was also a kite at the top of the aerial similar to that described by Edison in an expired patent which the Marconi Co. thought well to purchase.

The difference between Lodge's early achievements and that of Marconi is, after all, only one of degree; but there is no question that Mr. Marconi and his business friends have done more than anyone else in developing the commercial possibilities of telegraphy with Hertzian waves.

It must also be remembered that Sir Henry Jackson sent wireless messages between ships as early as 1895, but owing to his official position in the Navy the facts were not advertised.

In my opinion, therefore, Mr. Marconi cannot be said to be the pioneer of radio-telegraphy.

Development of radio-telegraphy.—In 1897 Lodge was granted the first patent for syntonised or selective telegraphy by proper adjustment of capacity and inductance. This is rendered more easy owing to the earth connection not being required. In fact, such a connection is a very disturbing factor.

Practically all systems are now syntonised, and more or less selective.

The Telefunken system is a combination of the inventions of Prof. Slaby, Count D'Arco and Prof. Braun. This system is used in the German army, and on all warships other than British and Italian, also at the numerous coast stations in the Baltic and the North Sea.

I was sorry to notice that two witnesses (Mr. Cuthbert Hall and Mr. Henniker Heaton) have spoken of Prof. Slaby as having copied Marconi. Mr. Heaton was corrected on this point some time ago by Prof. Slaby himself as well as by Dr. Silvanus Thompson, and seeing that Mr. Heaton admitted that he was not a technical expert, it seems strange that he should repeat this accusation against a distinguished foreign electrician.

The De Forest and Fessenden are other types of Hertzian spark systems.

The recent system of Poulsen is somewhat distinct from other methods, in that it employs continuous or persistent waves suffering practically no interruption, and its syntonic properties are remarkably high, permitting it to be very closely tuned, thereby rendering it less liable to interference.

There is also Ducretet in France, Popoff in Russia, and Guarini in Belgium, each with his own particular system.

Principles of Hertzian Waves.—A more or less continuous, persistent or undamped Hertzian wave is a distinct and definite improvement on that usually obtained from the ordinary spark discharge, where the waves are intermittent, and the amplitude although large at the commencement, quickly loses its energy. It is only the first oscillation which is really effective at the receiving station.

The Poulsen system gives practically a continuous train of waves, and the accumulated effect of these waves gives better results even with a much smaller amplitude than the single oscillation of much greater amplitude of the highly-damped wave train.

The Lodge-Muirhead system, although a spark method, gives an almost undamped wave train.

Syntony.—Syntonic wireless telegraphy involves a similar rate of oscillation in wave-length at the sending and receiving ends. This is effected by the proper adjustment of inductance and capacity as first shown by Lodge.

With Mr. Marconi's original system of an earthed vertical wire connected to the spark gap at the transmitting end no satisfactory "tuning" could be attained such as would provide suitable selectivity; and it is possible that this fact had something to do with the Post Office temporarily refusing licences to other companies since the passing of the 1904 Act, to avoid interference through stations being too close. For the main purposes of wireless telegraphy, immunity from interference by syntony is essential. Thus a selective system in time of war would be invaluable; a non-selective system almost worse than useless.

The Marconi Co. at one time claimed that their system would not interfere with or be interfered by other systems, but now, having obtained the best positions and desiring to maintain their monopoly, they argue in the reverse direction.

Supplementary Memorandum.—Dr. Fleming points out:—

1. That there are various types of apparatus for transmission and reception now in use, and are likely to be.
2. That it is an accepted scientific fact that intercommunication involves identity of type of apparatus, as well as in wave amplitude.
3. If it be supposed that several ships, each equipped with a different type of transmitter, attempting to communicate with a coast station, it is useless to say that the operator can adjust his apparatus to suit the arriving wave.

Here (1) is, of course, correct, but is rather an admission in view of the Marconi claim that all other systems are infringements of the 1896 patent. The accuracy of (2) and (3) is disproved by facts.

I would also remark that if the Marconi system is so superior to any other (as is alleged), or if all other systems are infringements (also alleged), why is it that the Committee have been informed that Mr. Marconi is shortly bringing out a system that really does produce continuous waves.

The whole trend of Dr. Fleming's extensive memorandum appears to be to impress the Committee that he and his company are the only real authorities on wireless telegraphy, and that the proper course is therefore to leave the entire matter in their hands.

The following from *The Electrician*, of September 17th, 1897, is interesting:—

"DR. OLIVER LODGE'S APPARATUS FOR WIRELESS TELEGRAPHY

"In connection with the patent of Signor Marconi, which we publish on the preceding pages, we are able to present our readers with two illustrations taken from photographs of some Hertzian-wave apparatus shown by Dr. Lodge at the Oxford meeting of the British Association in 1894. From these it will be seen that in 1894 Dr. Lodge publicly exhibited:—

"1. Oscillators with very large copper plates.

"2. Receivers of the coherer type with wings and wires attached to them.

"3. Coherers in sealed tubes.

"4. A trembling bell attachment to receivers of the coherer type, to assist these in decohering after the impingement of the electric oscillations.

"5. Morse instrument to shake the filings.

"In fact, Dr. Lodge published enough three years ago to enable the most simple-minded practician to compound a system of practical telegraphy without deviating a single hair's-breath from Lodgian methods. Both at Oxford and at the Royal Institution, Dr. Lodge described and exhibited publicly in operation a combination of sending and receiving apparatus constituting a system of telegraphy substantially the same as that now claimed in the patent we have referred to."

Finally, I would say that in his memoranda Dr. Fleming appears to have been endeavouring to act in the capacity suggested in the anonymous letter marked A, amongst those I hand in. It will be observed that the writer of this letter suggested that as Tyndall is no more with us, Mr. Marconi should serve as expert on the Committee. But as Mr. Marconi and Dr. Fleming are interested parties, that would scarcely have been a suitable arrangement.

The author of the letter can be readily traced first by an examination of the constitution of the body he signs himself as belonging to, and, secondly, from a list of the directors of the Marconi Co.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

"Tripin Combination" Switches.

MESSRS. A. P. LUNDBERG & SON, of Liverpool Road, Islington, give in a new circular that they are now about to issue, particulars of various adaptations of single and two-way types of their Tripin combined switch and three-pin wall connection. These are useful adaptations of the patent "Pivot" single and two-way switch movements, which depend upon a variable leverage action, producing a safe locking of the contact arm when conveying current, thus rendering it impossible for any vibration, such as is met on board ship, to jar the contact arm into the "off" position and extinguish the lamps. Contacts for the insertion of a three-pin plug are

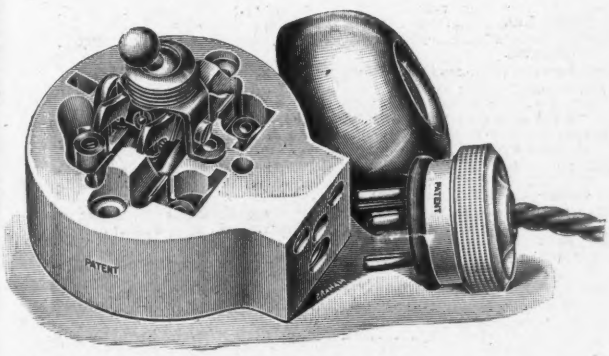


FIG. 1.

arranged in the base, such plug being provided with one large and two small contact pins to prevent insertion in any but the correct manner. In the single-way type the plug is inserted from beneath, while in the two-way type it may be inserted from either the right or left-hand side, whichever is more convenient. The three-pin plug used is interchangeable with standard patterns of surface and flush types of "Tripin" connections. The two-way type is adaptable for the convenient charging of motor-car ignition cells, on ordinary D.C. lighting circuits, in series with lamps or radiators. This type can also be usefully employed to replace any single-way switch, without alteration of the existing wiring, with the result that while the replacing switch may still control the circuit as before, it also allows provision for a flexible wire extension to a portable "see-saw" two-way pear switch, which has a similar control over the circuit to the fixed two-way "Tripin combination." The single-way type may be conveniently arranged for controlling small radiators by arranging all plug pins and tubes of uniform size, the various degrees of heat obtainable depending upon how the plug is inserted. Should circumstances require such an arrangement, *e.g.*, when fixed on the radiator itself, the base parts of both types can be arranged with contact pins, instead of sockets, and current fed to the switch by means of a detachable socket plug. All standard sizes of cover fitted to the 5-amp "Pivot" switch are

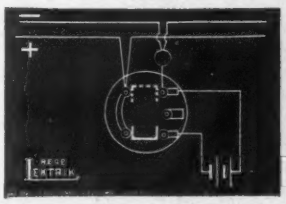


FIG. 2.

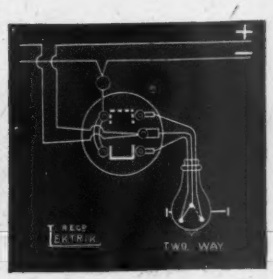


FIG. 3.

interchangeable with these types. In the two-way type (fig. 1), the two contact arms are insulated from each other and from the cover and other metal parts of the switch. The fibre discs on the plugs are arranged for cord gripping, and are prepared by a special process which increases their usual insulation resistance six-fold.

We show in the accompanying diagrams (figs. 2 and 3) a couple of the most useful adaptations of the two-way type.

Capstan Lathes.

We recently mentioned an illustrated list of capstan lathes issued by the BIRMINGHAM ENGINEERING CO., LTD., of Hooper Street, Spring Hill, Birmingham. We now illustrate their No. 6 Turret lathe which is made with a friction geared head as shown, or can be made ungeared. A hand traversing cross slide, power feed to turret, automatic stops for each tool in turret, &c., can all be added where required. The machine is stated to be unusually powerful for its size, the object being to get the best possible results from high-speed tool steels. The spindle is hardened and ground, and the cone pulley largest diameter is 12 in. × 3¼ in. face; the countershaft pulleys are 12 in. diameter × 3½ in. face. The bearings are extra long, and the turret slide is 29 in. long, the length of the base being 18 in. The working travel of the turret is 9 in., which is exceptionally long for a lathe of this size. The height from centre of holes in turret to top of slide is 2⅜ in. When arranged as a chucking lathe it will swing 8 in. diameter over the cross slide. The net weight of the tool as shown, fig. 4, is about 18 cwt. It admits 1⅜ in. through the automatic chuck, the hole in the spindle being 2 in. diameter.

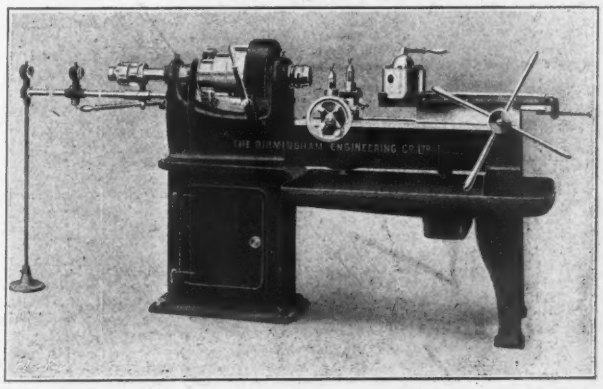


FIG. 4.

The company also make a lighter machine (No. 2) intended for brasswork. It admits 1½ in. through the automatic chuck, which is operated by a special arrangement of compound levers giving a very powerful grip on the bar. All parts are substantial, the turret slide moving on V's, and the turret itself revolving on a V ring. This machine will turn up to 4½ in. long. The cone pulley is 9 in. diameter on the largest step, the countershaft pulleys being 10 in. diameter. The equipment for both these lathes includes reversing countershaft, spanners, tool posts, &c.

Continuous to Continuous Current Transformer.

THE CRYPTO ELECTRICAL CO., of 155 and 157, Bermondsey Street, London, S.E., have just brought out a new continuous to continuous current transformer, which can be wound on the primary side for any voltage up to 250 volts, and has an output on the secondary side of 15 volts 7 amps. It is shown in the accompanying illustration (fig. 5). The Crypto Co. have for years been manufacturing a transformer similar to this, but the primary has been wound for alternating current. The present machine is being put on the market to reduce the voltage of continuous-current mains in an efficient way for the purpose of charging motor-car ignition and lighting cells.

It is stated that the cost of charging six accumulators, at a charging rate of 3·5 amps., by means of this transformer, will work out at 4d. for an eight-hour charge, whereas the same accumulators would cost 1s. 3d. or more when charged through lamps. This

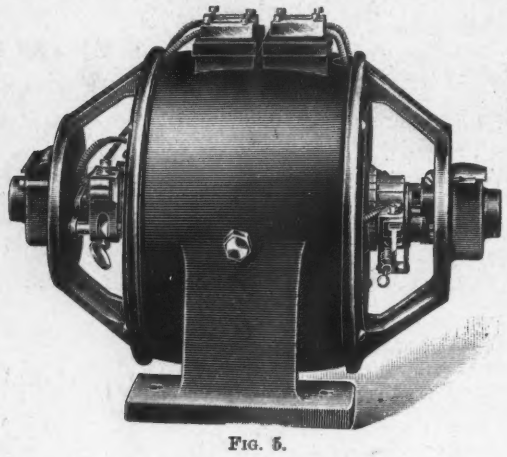


FIG. 5.

calculation does not, however, truly represent the full saving, owing to the current used by the transformer being charged up at the power rate, which is usually 2d. per unit or less.

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this Journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

15,099. "Electrical dumb-bells, exercisers and the like." P. B. FLETCHER. July 1st.

15,100. "Improvements in or relating to electric clocks and the like." A. C. STRAY. July 1st. (Complete.)

15,136. "Improved contact-breaker for electrical ignition apparatus for internal combustion engines." R. BOSCH. July 1st. (Complete.)

15,147. "Improvements in primary galvanic batteries." W. THOMPSON. July 1st.

15,151. "Improvements in or connected with dynamo-electric machine of the neutralised conduction type." V. A. FYNN. July 1st.

15,156. "New or improved method of and means for electrically transmitting images and rendering them distinctly visible." R. T. HAINES. July 1st.

15,169. "Improvements relating to combined telegraph and telephone apparatus." W. K. L. DICKSON. July 1st. (Complete.)

15,171. "Improvements in methods of insulating sheet metal and other electric conductors." THE BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 1st.

15,208. "Improvements in the induction and ignition means of internal combustion engines." S. P. A. SOCIETA PIEMONTESE AUTOMOBILI ANSALDI AND CEIRANO. (Date applied for under Patents Act, 1901, October 4th, 1906, being date of application in Italy.) July 2nd. (Complete.)

15,219. "Improvements in and connected with the driving gear of electric tramcars." V. G. LIRONI. July 2nd. (Complete.)

15,234. "Improvements relating to electrical signalling apparatus for use with guns." A. T. DAWSON and G. T. BUCKHAM. July 2nd.

15,262. "Improvements in controlling mechanism for electric circuits." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 2nd.

15,288. "Improvements in electric hoists." H. VON KRAMER. July 3rd.

15,290. "Appliance for rapidly making and breaking an electrical circuit automatically and preventing it being made and broken slowly or left in an intermediate position." J. STEVENSON. July 3rd.

15,302. "Improvements in starting devices for alternating current electric motors." A. ECKSTEIN, A. C. HEAP and D. B. MELLIS. July 3rd.

15,235. "Improvements in equalising devices for alternating current circuits." J. S. PECK. July 3rd.

15,338. "Improvement relating to electrodes for search lights." GEBRUDER SIEMENS & Co. (Date applied for under Patents Act, 1901, December 17th, 1906, being date of application in Germany.) July 3rd. (Complete.)

15,357. "New or improved method of and means for electrically transmitting images, pictures and like representations and reproducing same." R. T. HAINES. July 3rd.

15,363. "Improvements in electrically-driven pulley blocks." A. A. C. GESE. July 3rd. (Complete.)

15,366. "Improvements in and relating to controller regulators." R. AMBERTON and E. SCHATTNER. July 3rd.

15,367. "Improvements in and relating to methods of producing refractory electric conductors." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 3rd

15,394. "Improved wall box for electric switches." G. E. F. FINCH. July 4th.

15,412. "Improvements in receivers for wireless telegraphy." L. H. WALTER. July 4th.

15,418. "Improvement in current distributing systems." SIEMENS-SCHUCKERT-WERKE G.M.B.H. (Date applied for under Patents Act, 1901, July 5th, 1906, being date of application in Germany.) July 4th. (Complete.)

15,422. "Device for the automatic cleaning of sparking plugs of internal combustion engines and accelerating the starting of the said engines and the like." A. E. LAMKIN and E. T. CROFTS. July 4th.

15,441. "Improvements in or relating to voltage regulators." F. CONRAD. (Date applied for under Patents Act, 1901, July 9th, 1906, being date of application in United States.) July 4th. (Complete.)

15,442. "Improvements in or relating to voltage regulators." F. CONRAD. (Date applied for under Patents Act, 1901, July 9th, 1906, being date of application in United States.) July 4th. (Complete.)

15,450. "Improvements in and relating to electric telegraphy." A. MUIRHEAD. July 4th.

15,451. "Improvements in and relating to the manufacture of refractory electrical conductors." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 4th.

15,452. "Improvements in and relating to dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 4th.

15,453. "Improvements in and relating to single-phase electric motors." M. LATOUR. (Date applied for under Patents Act, 1901, July 5th, 1906, being date of application in France.) July 4th. (Complete.)

15,493. "Improvements in ships' compasses." J. W. GILLIE. July 5th.

15,505. "Folding electric-light bath cabinet." C. M. HOLMQUIST. July 5th.

15,510. "Improved process for the manufacture of illuminating bodies for electric incandescence lamps." DEUTSCHE GASGLUHLICHT ART.-GES (Auerges). (Date applied for under Patents Act, 1901, July 11th, 1906, being date of application in Germany). July 5th. (Complete.)

15,514. "Improvements in signalling and electric search-light apparatus." S. O. COWPER-COLES. July 5th.

15,515. "Improvements in electric conductors and resistances." S. O. COWPER-COLES. July 5th.

15,522. "Improved means for operating gas taps, electric light switches, and the like." J. N. MASKELYNE. July 5th.

15,525. "Earthing contact for use in connection with flexible conductors and the like." P. SPEEDY and G. LEVERIDGE EYNON. July 5th.

15,532. "Improved telegraph or signalling system and apparatus." P. M. JUSTICE (Sub-Target Co., United States). July 5th. (Complete.)

15,540. "Improved sparking plug for internal combustion engines." T. L. JONES. July 5th.

15,549. "Improvements in and relating to alternating-current dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD. July 5th.

15,551. "Improvements in electricity meters for use with alternating currents." H. J. HADDAN. (Bergmann Elektricitätswerke Aktiengesellschaft, Germany.) July 5th. (Complete.)

15,579. "Improvements in boxes, cells or electrolyte containers for electric accumulators and the like." B. COOKSON. July 6th.

15,580 "Improvements in apparatus for use in cleaning the interior of accumulator cells and for like purposes." B. COOKSON. July 6th.

15,594. "Improved armature for magneto-induction machines." G. C. DYMOND. (E. Eisemann & Co., Germany.) July 6th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1906.

HARMONIC SIGNALLING FOR PARTY-LINE TELEPHONE SYSTEMS. W. H. Wheatley. (Firm of C. Lorenz.) 14,090. June 19th.

CONTROLLERS SUITABLE FOR ELECTRO-MOTORS. J. Schuil and A. L. Reyrolle. 14,511. June 25th.

SELECTING SWITCH MECHANISM SUITABLE FOR ADVERTISING, SIGNALLING AND LIKE PURPOSES. G. C. Fricker. 14,590. June 26th.

ELECTRIC ARC LAMPS. J. Brockie. 14,608. June 26th.

CURRENT SUPPLY SYSTEMS FOR TELEPHONE AND THE LIKE CIRCUITS. British Thomson-Houston Co. (General Electric Co.) 14,789. June 28th.

INDUCTOR ALTERNATORS AND LIKE DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. (General Electric Co.) 15,135. July 3rd.

SOLENOID OR PNEUMATICALLY OPERATED ELECTRIC SWITCHES. British Thomson-Houston Co. (General Electric Co.) 15,816. July 5th.

APPARATUS FOR LAYING ELECTRIC CONDUCTORS AND THE LIKE. E. C. R. Marks. (A. Bostrom.) 16,425. July 20th.

AUTOMATIC ELECTRIC FIRE ALARM. C. W. Moule and W. M. Hasell. 17,293. August 1st.

PROCESSES FOR PRODUCING ELECTRIC DISCHARGES. H. Pauling. 18,435. August 16th. (Rights under Patents, &c., Act, 1901, not granted.)

ELECTRIC MOTORS. British Thomson-Houston Co. (General Electric Co.). 19,120. August 27th.

RECEIVERS FOR WIRELESS TELEGRAPHY. A. Artom. 19,805. September 5th.

REGULATION OF THE VOLTAGE OF ALTERNATING ELECTRIC CURRENT DISTRIBUTION SYSTEMS. Allgemeine Elektricitäts-Ges. 20,050. September 8th. (Date applied for under International Convention, September 9th, 1905.)

CONVERSATION COUNTERS IN TELEPHONE INSTALLATIONS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 20,733. September 18th.

ELECTRIC SIGNALLING APPARATUS. Felten & Guilleaume-Lahmeyer-werke Akt.-Ges. 21,164. September 24th. (Date applied for under International Convention, September 22nd, 1905.)

METERS APPLICABLE FOR USE IN THE SUPPLY OF ELECTRICITY, GAS OR THE LIKE AT TWO DIFFERENT TARIFFS. G. C. M. Hardingham. (Firm of Landis & Hyr, formerly Theiler & Co.) 24,197. October 30th.

ELECTRIC SWITCHES FOR RAILWAY SIGNALLING AND LIKE PURPOSES. A. Bevan. 24,532. November 2nd.

ELECTRIC MOTORS. B. G. Lamme. 27,269. (Date applied for under International Convention, December 4th, 1905.)

1907.

ALTERNATING CURRENT COMMUTATOR MOTORS. Siemens-Schuckertwerke Ges. 1,212. January 17th. (Date applied for under International Convention, January 20th, 1906.)

APPARATUS FOR ELECTRICALLY INDICATING MUSIC NOTES UPON THE KEYBOARD OF A PIANOFORTE OR OTHER SIMILAR INSTRUMENT. 1,645. A. R. Hakoumoff. January 22nd.

ALTERNATING CURRENT COMMUTATING ELECTRIC MACHINES. Allgemeine Elektricitäts-Ges. 1,662. January 22nd. (Date applied for under International Convention, January 23rd, 1906.)

SYSTEMS OF ELECTRICAL DISTRIBUTION. P. C. Hewitt. 3,880. February 16th. (Date applied for under International Convention, March 14th, 1906.)

METHODS AND MEANS OF PRODUCING OSCILLATORY CURRENTS FROM CONTINUOUS CURRENTS OF ELECTRICITY. H. Manders. 5,164. March 4th.

ALLOYS FOR THE INACTIVE CARRIES OR FOR OTHER METALLIC PARTS OF ACCUMULATORS WITH INVARIABLE ELECTROLYTE, AND ACCUMULATORS CONSTRUCTED WITH SUCH CARRIERS OR METALLIC PARTS. Nya Ackumulator Aktiebolaget Jungner. 6,522. March 18th. (Date applied for under International Convention, March 30th, 1906.)

BOX OR COVERING FOR LEAD-CASED ELECTRIC CABLES. J. Stratton and E. A. Claremont. 1,141. January 16th.

INSULATORS FOR ELECTRIC CONDUCTORS. H. H. Lake. (W. G. Clark.) 1,362. January 18th.

SWITCHES FOR ELECTRIC CIRCUITS. R. P. Jackson. 4,000. February 18th. (Date applied for under International Convention, March 3rd, 1906.)

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ELECTRICAL ENGINEERS AND CONTRACTORS,

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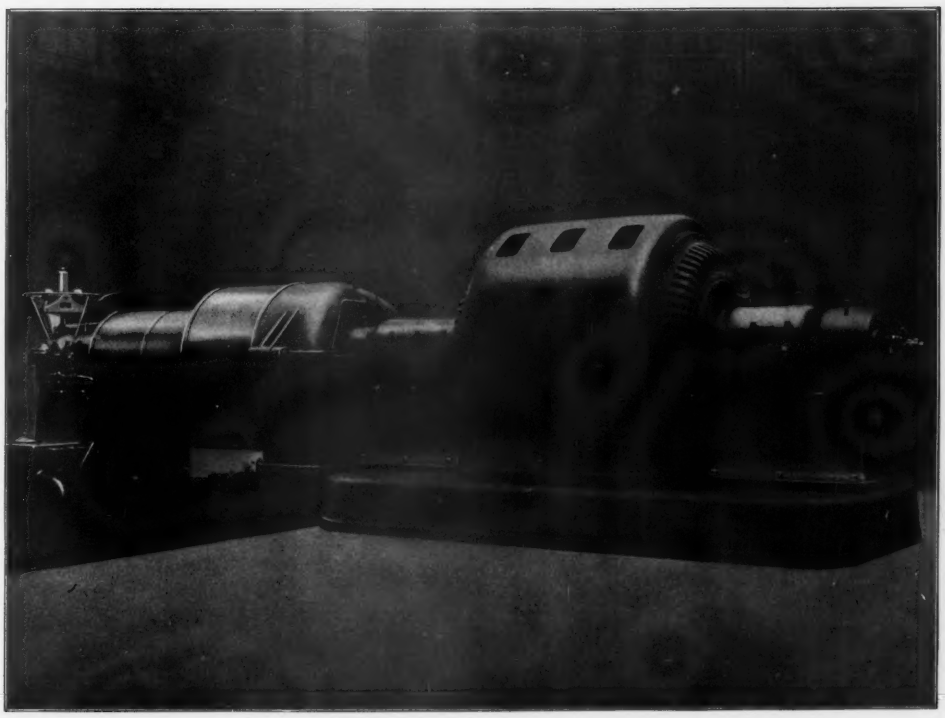
Advertising Supplement No. 5. JULY, 1907.



2,350 K.V.A. PEEBLES TURBO-ALTERNATOR, STALEYBRIDGE, HYDE, MOSSLEY, AND DUKINFIELD JOINT BOARD. A DUPLICATE UNIT IS NOW ON ORDER.

Turbo-Alternators.

FOR economy and efficiency under the conditions prevailing in modern power stations, the turbo-generator unit has paramount advantages. Its development has involved new problems of great difficulty in both mechanical and electrical design, and much costly experimental work. The machines described in the following pages are the outcome of the accumulated experience of several years, and represent the latest word in electrical power plant.

Turbo-Alternators.

General Type.

AS usual in modern alternators, the revolving field design is adopted, the precise field construction adopted being varied to suit the conditions in individual cases. The photographs indicate clearly the appearance of parts of standard machines.

FIG. 2.—STATOR OF 2,000 K.W. THREE-PHASE E.H.T. TURBO-GENERATOR.

Stator Core.

THE stator is, as in all Peebles alternators, built up of the finest quality of charcoal iron laminations, and provided with ample ventilation. Special processes are employed for insulating the core plates, and the iron loss reduced to an absolute minimum, thus contributing largely to the well known high efficiency of the machines.

Bruce Peebles & Co. Ltd.

Turbo-Alternators.

Winding.

STANDARD windings are of the partially closed slot form, and the number of slots per pole per phase is unusually large. This entails increased labour in construction, but the safety and improved electrical characteristics amply compensate the outlay. The coils are embedded in tubes of pure mica, and the disadvantage of threading single wires through long slots is avoided by our system of winding. The end connections are carried well clear of the core, and very strongly supported. In low voltage machines the conductors are of copper rod, with solid end-connectors of strong design.

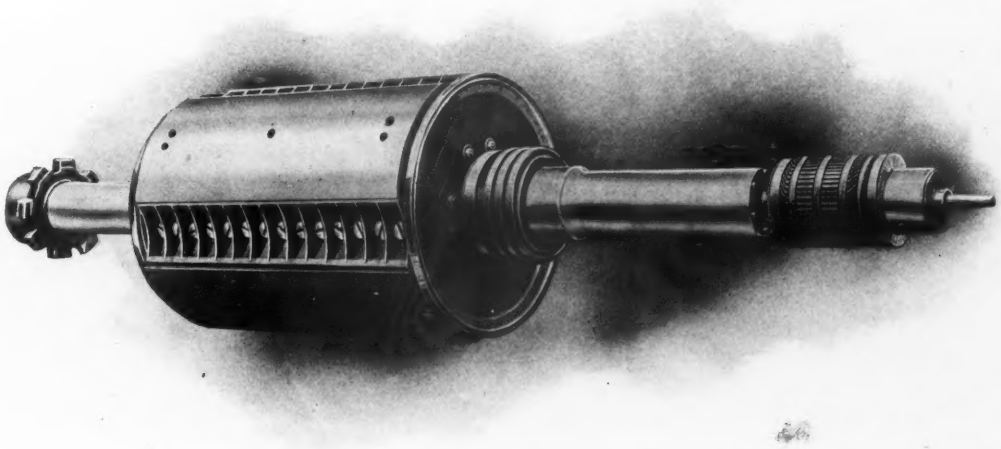


FIG. 3.—ROTOR OF 2,000 K.W., 1,200 R.P.M., 40 CYCLE TURBO-ALTERNATOR.

Rotor.

THE rotor construction cannot be rigidly standardised, since it must vary with the size, speed, and number of poles. The cardinal requirements are ample mechanical strength and solidity, to withstand the great centrifugal stresses and effectually prevent any internal movement of parts which might throw the rotor out of balance, and so cause trouble. The rotor illustrated in Fig. 3 is a four-pole structure of solid steel, cast under pressure to ensure homogeneity; in some cases, however, laminated rotors are built. The windings are put on under pressure and strongly supported by phosphor bronze angle clamps.

Turbo-Alternators.

Characteristics.

PEEBLES turbo-alternators are notably quiet in operation, owing to the absence of sharp angles in the air gap. The regulation is close, and the efficiency very high, while the wave form is shown by oscillograph readings to be almost perfect. The machines are very easily synchronised, and will run in parallel with any class of synchronous alternator without hunting.

Further particulars will be found in our Pamphlet No. 19.

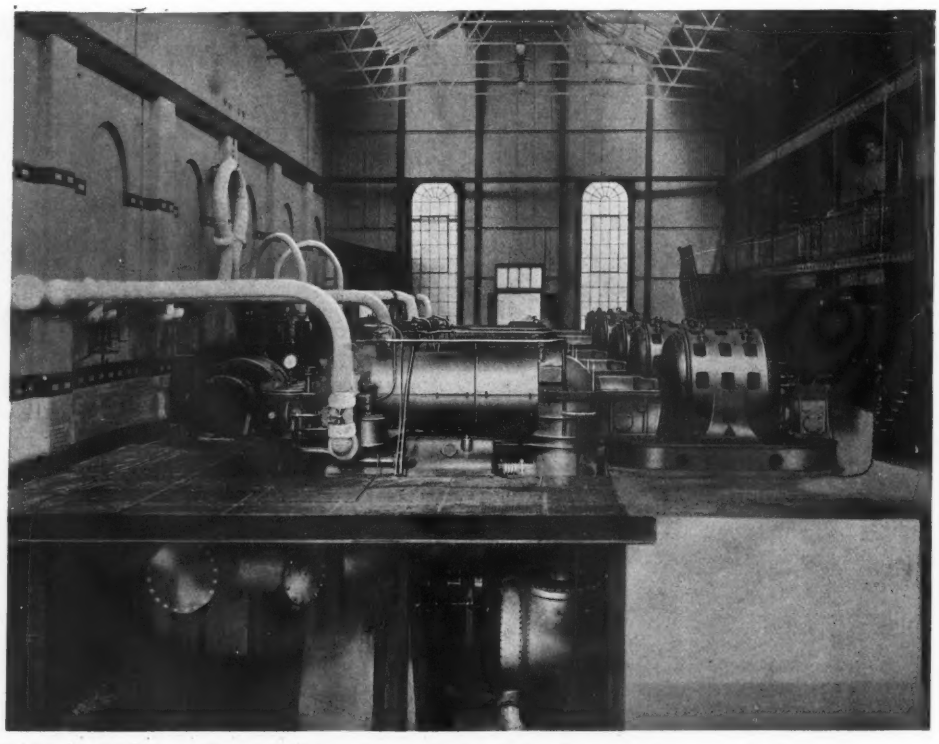


FIG. 4.—FIVE PEEBLES 1,550 K.V.A., 6,600 VOLTS TURBO-ALTERNATORS, DURHAM COLLIERIES POWER STATION.

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